(2)

INSTALLATION RESTORATION PROGRAM

PRELIMINARY ASSESSMENT

201st RED HORSE, Civil Engineering Flight

Fort Indiantown Gap Air National Guard Station
Pennsylvania Air National Guard
Annville, Pennsylvania

February 1991

AD-A238 960

AIR NATIONAL GUARD

91-06737

54

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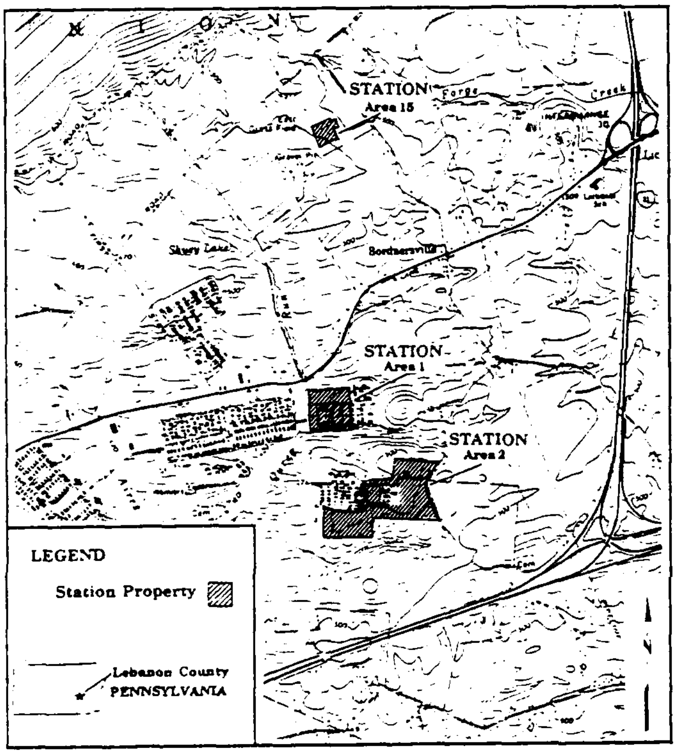

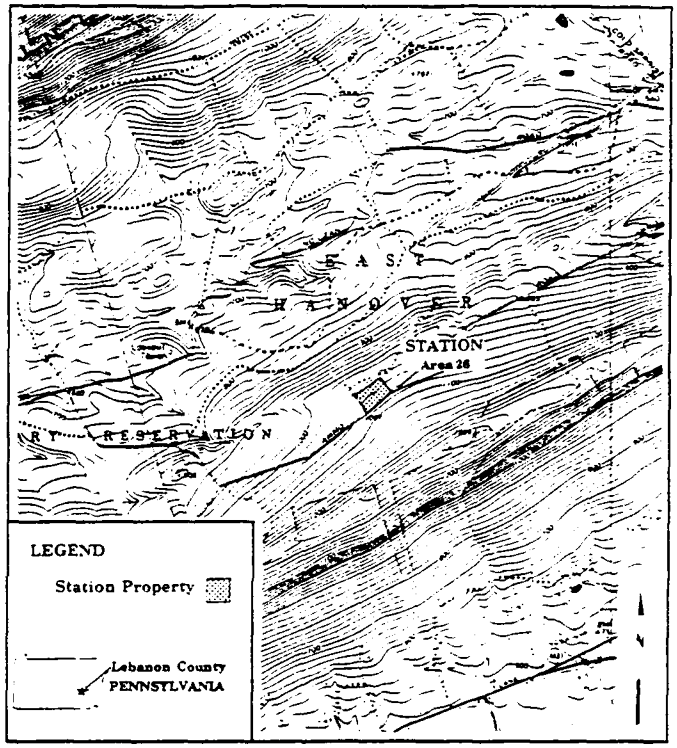

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REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. AGENCY USE ONLY *(Leave blank)*

2. REPORT DATE
February 1991

3. REPORT TYPE AND DATES COVERED
Preliminary Assessment

4. TITLE AND SUBTITLE Preliminary Assessment
201st RED HORSE, Civil Engineering Flight
Fort Indiantown Air National Guard Station
Annville, Pennsylvania

5. FUNDING NUMBERS

6. AUTHOR(S)
N/A

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
Science and Technology, Inc.
704 South Illinois Ave.
Oakridge, TN 37830

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
Hazardous Waste Remedial Actions Program
Oakridge, TN

Air National Guard Bureau
Andrews AFB, Maryland 20331

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution is unlimited

12b. DISTRIBUTION CODE

13. ABSTRACT *(Maximum 200 words)*
Preliminary environemntal assessment for Fort Indiantown Gap Air National Guard Station, as part of the Installation Restoration Program. The report reflects data gathered from records reviews, interviews, and a site visit. Three sites were identified as potentially contaminated and recommended for further investigation.

14. SUBJECT TERMS Pennsylvania Air National Guard; Fort Indiantown Gap Air National Guard Station, Annville, Pennsylvania; Installation Restoration Program; Preliminary Assessment; Waste Holding Area; waste disposal area.

15. NUMBER OF PAGES

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT
Unclassified

18. SECURITY CLASSIFICATION OF THIS PAGE

19. SECURITY CLASSIFICATION OF ABSTRACT

20. LIMITATION OF ABSTRACT

INSTALLATION RESTORATION PROGRAM
PRELIMINARY ASSESSMENT

201st RED HORSE, CIVIL ENGINEERING FLIGHT
271st COMBAT COMMUNICATIONS SQUADRON
211th ENGINEERING INSTALLATION SQUADRON
203rd WEATHER FLIGHT
112th TACTICAL FIGHTER GROUP DOMAR
201st REGIONAL EQUIPMENT OPERATORS TRAINING SCHOOL
FORT INDIANTOWN GAP AIR NATIONAL GUARD STATION
PENNSYLVANIA AIR NATIONAL GUARD
ANNVILLE, PENNSYLVANIA

Prepared for

National Guard Bureau
Andrews Air Force Base, Maryland 20331-6008

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Contract No. DE-AC05-87OR21704

A-1

Submitted to

HAZWRAP Support Contractor Office
Oak Ridge, Tennessee
Operated by Martin Marietta Energy Systems, Inc.
for the Department of Energy,
Under Contract DE-AC05-84OR21400

February 1991

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ACRONYM LIST

AGE	Aerospace Ground Equipment
ANG	Air National Guard
CCS	Combat Communications Squadron
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CES	Civil Engineering Squadron
CFR	Code of Federal Regulations
DEQPPM	Defense Environmental Quality Program Policy Memorandum
DERP	Defense Environmental Restoration Program
DoD	Department of Defense
DOMAR	Director of Operations, Military Air Range
DOT	Department of Transportation
DRMO	Defense Reutilization and Marketing Office
EIS	Engineering Installation Squadron
EO	Executive Order
EPA	Environmental Protection Agency
FR	Federal Register
FS	Feasibility Study
HARM	Hazard Assessment Rating Methodology
HAS	Hazard Assessment Score
HAZWRAP	Hazardous Waste Remedial Actions Program
IRP	Installation Restoration Program
MOGAS	Automotive Gasoline
NGB	National Guard Bureau
OSHA	Occupational Safety and Health Administration
OWS	Oil/Water Separator
PA	Preliminary Assessment
PCB	Polychlorinated Biphenyls
PL	Public Law
POC	Point of Contact
POL	Petroleum, Oil, and Lubricant
RCRA	Resource Conservation and Recovery Act of 1976
R&D	Research and Development
REOTS	Regional Equipment Operators Training School
RHCEF	Red Horse, Civil Engineering Flight
RI	Remedial Investigation
SARA	Superfund Amendments and Reauthorization Act of 1986
SciTek	Science & Technology, Inc.
SI	Site Investigation
TCS	Tactical Control Squadron
TFG	Tactical Fighter Group
USAF	United States Air Force
USC	United States Code

ACRONYM LIST (continued)

USDA	United States Department of Agriculture
USGS	United States Geological Survey
UST	Underground Storage Tank
WF	Weather Flight

EXECUTIVE SUMMARY

A. INTRODUCTION

Science & Technology, Inc. (SciTek) was retained to conduct the Installation Restoration Program (IRP) Preliminary Assessment (PA) of the Fort Indiantown Gap Air National Guard (ANG) Station [hereinafter referred to as the Station], Pennsylvania Air National Guard, located on the Fort Indiantown Gap Military Reservation north of Annville, Pennsylvania. For the purpose of this document, the Station shall include the total area that is used exclusively at Fort Indiantown Gap.

The following six organizations occupy the Station:

- o 112th Tactical Fighter Group - Director of Operations, Military Air Range (TFG DOMAR)
- o 201st RED HORSE, Civil Engineering Flight (RHCEF)
- o 201st Regional Equipment Operators Training School (REOTS)
- o 203rd Weather Flight (WF)
- o 211th Engineering Installation Squadron (EIS)
- o 271st Combat Communications Squadron (CCS)

The PA included the following activities:

- o an on-site visit, including interviews with a total of ten persons familiar with Station operations, and field surveys by SciTek representatives during the week of May 29-June 1, 1990;
- o acquisition and analysis of information on past hazardous materials use, waste generation, and waste disposal at the Station;
- o acquisition and analysis of available geological, hydrological, meteorological, and environmental data from federal, state, and local agencies; and
- o the identification and assessment of sites on the Station that may have been contaminated with hazardous wastes.

B. MAJOR FINDINGS

The organizations at the Station have used hazardous materials and generated small amounts of wastes in mission-oriented operations and maintenance at the Station since 1971.

Operations that have involved the use of hazardous materials and the disposal of hazardous wastes include vehicle maintenance and aerospace ground equipment (AGE) maintenance. The hazardous wastes disposed of through these operations include varying quantities of petroleum oil-lubricant (POL) products, acids, paints, thinners, strippers, and solvents.

The field surveys and interviews resulted in the identification of three sites that exhibit the potential for contaminant presence and migration.

C. CONCLUSIONS

It has been concluded there are three sites where a potential for contaminant presence exists.

- Site No. 1 - Compound Access Road/Parking Lot (HAS - 69)
- Site No. 2 - Waste Holding Area (HAS - 68)
- Site No. 3 - Old Waste Holding Area (HAS - 61)

D. RECOMMENDATIONS

Further work under the IRP is recommended for the identified sites to determine the presence or absence of contamination.

I. INTRODUCTION

A. Background

The Fort Indiantown Gap Air National Guard (ANG) Station [hereinafter referred to as the Station], Pennsylvania Air National Guard, is located on the Fort Indiantown Gap Military Reservation north of Annville, Pennsylvania. Six units presently occupy the property: 112th Tactical Fighter Group - Director of Operations, Military Air Range (TFG DOMAR); 201st RED HORSE, Civil Engineering Flight (RHCEF); 201st Regional Equipment Operators Training School (REOTS); 203rd Weather Flight (WF); 211th Engineering Installation Squadron (EIS); and 271st Combat Communications Squadron (CCS). Units have been active at the Station since 1971. Both the past and current operations have involved the use of potentially hazardous material and the disposal of wastes. Because of the use of these materials and the disposal of resultant wastes, the National Guard Bureau (NGB) has implemented the Installation Restoration Program (IRP).

The IRP is a comprehensive program designed to:

- o Identify and fully evaluate suspected problems associated with past hazardous waste disposal and/or spill sites on Department of Defense (DoD) installations and

- o Control hazards to human health, welfare, and the environment that may have resulted from these past practices.

During June 1980, DoD issued a Defense Environmental Quality Program Policy Memorandum (DEQPPM 80-6) requiring identification of past hazardous waste disposal sites on DoD installations. The policy was issued in response to the Resource Conservation and Recovery Act (RCRA) of 1976 and in anticipation of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, Public Law (PL) 96-510) of 1980, commonly known as "Superfund." In August 1981, the President delegated certain authority specified under CERCLA to the Secretary of Defense via an Executive Order (EO 12316). As a result of EO 12316, DoD revised the IRP by issuing DEQPPM 81-5 (December 11, 1981), which reissued and amplified all previous directives and memoranda.

Although the DoD IRP and the Environmental Protection Agency (EPA) Superfund programs were essentially the same, differences in the definition of program activities and lines of authority resulted in some confusion between DoD and state/federal regulatory agencies. These difficulties were rectified via passage of the Superfund Amendments and Reauthorization Act (SARA, PL-99-499) of 1986. On January 23, 1987, Presidential Executive Order EO 12580

was issued. EO 12580 effectively revoked EO 12316 and implemented the changes promulgated by SARA.

The most important changes effected by SARA included the following:

- Section 120 of SARA provides that federal facilities, including those in DoD, are subject to all provisions of CERCLA/SARA concerning site assessment, evaluation under the National Contingency Plan [40CFR300], listing on the National Priorities List, and removal/remedial actions. DoD must therefore comply with all the procedural and substantive requirements (guidelines, rules, regulations, and criteria) promulgated by the EPA under Superfund authority.

- Section 211 of SARA also provides continuing statutory authority for DoD to conduct its IRP as part of the Defense Environmental Restoration Program (DERP). This was accomplished by adding Chapter 160, Sections 2701-2707 to Title 10 United States Code (10 USC 160).

- SARA also stipulated that terminology used to describe or otherwise identify actions carried out under the IRP shall be substantially the same as the terminology of the regulations and guidelines issued by the EPA under their Superfund authority.

As a result of SARA, the operational activities of the IRP are currently defined and described as follows:

- **Preliminary Assessment**

  The Preliminary Assessment (PA) process consists of personnel interviews and a records search designed to identify and evaluate past disposal and/or spill sites that might pose a potential and/or actual hazard to public health, public welfare, or the environment. Previously undocumented information is obtained through the interviews. The records search focuses on obtaining useful information from aerial photographs; Station plans; facility inventory documents; lists of hazardous materials used at the Station; Station subcontractor reports; Station correspondence; Material Safety Data Sheets; federal/state agency scientific reports and statistics; federal administrative documents; federal/state records on endangered species, threatened species, and critical habitats; documents from local government offices; and numerous standard reference sources.

- **Site Inspection/Remedial Investigation/Feasibility Study**

The Site Inspection consists of field activities designed to confirm the presence or absence of contamination at the potential sites identified in the PA. An expanded Site Inspection has been designed by the Air National Guard as a Site Investigation. The Site Investigation (SI) will include additional field tests and the installation of monitoring wells to provide data from which site-specific decisions regarding remediation actions can be made. The activities undertaken during the SI fall into three distinct categories: screening activities, confirmation and delineation activities, and optional activities. Screening activities are conducted to gather preliminary data on each site. Confirmation and delineation activities include specific media sampling and laboratory analysis to confirm either the presence or the absence of contamination, levels of contamination, and the potential for contaminant migration. Optional activities will be used if additional data is needed to reach a decision point for a site. The general approach for the design of the SI activities is to sequence the field activities so that data are acquired and used as the field investigation progresses. This is done in order to determine the absence or presence of contamination in a relatively short period of time, optimize data collection and data quality, and to keep costs to a minimum.

The Remedial Investigation (RI) consists of field activities designed to quantify and identify the potential contaminant, the extent of the contaminant plume, and the pathways of contaminant migration.

If applicable, a public health evaluation is performed to analyze the collected data. Field tests, which may necessitate the installation of monitoring wells or the collection and analysis of water, soil, and/or sediment samples, are required. Careful documentation and quality control procedures in accordance with CERCLA/SARA guidelines ensure the validity of data. Hydrogeologic studies are conducted to determine the underlying strata, groundwater flow rates, and direction of contaminant migration. The findings from these studies result in the selection of one or more of the following options:

1. **No Further Action** - Investigations do not indicate harmful levels of contamination that pose a significant threat to human health or the environment. The site does not warrant further IRP action, and a Decision Document will be prepared to close out the site.

2. **Long-Term Monitoring** - Evaluations do not detect sufficient contamination to justify costly remedial actions. Long-term monitoring may be recommended to detect the possibility of future problems.

3. **Feasibility Study** - Investigation confirms the presence of contamination that may pose a threat to human health and/or the environment, and some sort of remedial action is indicated. The Feasibility Study (FS) is therefore designed and developed to identify and select the most appropriate remedial action. The FS may include individual sites, groups of sites, or all sites on an installation. Remedial alternatives are chosen according to engineering and cost feasibility, state/federal regulatory requirements, public health effects, and environmental impacts. The end result of the FS is the selection of the most appropriate remedial action with concurrence by state and/or federal regulatory agencies.

o **Remedial Design/Remedial Action**

The Remedial Design involves formulation and approval of the engineering designs required to implement the selected remedial action. The Remedial Action is the actual implementation of the remedial alternative. It refers to the accomplishment of measures to eliminate the hazard or, at a minimum, reduce it to an acceptable limit. Covering a landfill with an impermeable cap, pumping and treating contaminated groundwater, installing a new water distribution system, and in situ biodegradation of contaminated soils are examples of remedial measures that might be selected. In some cases, after the remedial actions have been completed, a long-term monitoring system may be installed as a precautionary measure to detect any contaminant migration or to document the efficiency of remediation.

o **Research and Development**

Research and Development (R&D) activities are not always applicable for an IRP site but may be necessary if there is a requirement for additional research and development of control measures. R&D tasks may be initiated for sites that cannot be characterized or controlled through the application of currently available, proven technology. It can also, in some instances, be used for sites deemed suitable for evaluating new technologies.

o **Immediate Action Alternatives**

At any point, it may be determined that a former waste disposal site poses an immediate threat to public health or the environment, thus necessitating prompt removal of the contaminant. Immediate action, such as limiting access to the site, capping or removing contaminated soils, and/or providing an alternate water supply may suffice as effective

control measures. Sites requiring immediate removal action maintain IRP status in order to determine the need for additional remedial planning or long-term monitoring. Removal measures or other appropriate remedial actions may be implemented during any phase of an IRP project.

B. Purpose

The purpose of this IRP PA is to identify and evaluate suspected problems associated with past waste handling procedures, disposal sites, and spill sites on Station property.

The potential for migration of hazardous contaminants was evaluated by visiting the Station, reviewing existing environmental data, analyzing Station records concerning the use of hazardous materials and the generation of hazardous wastes, and conducting interviews with current Station personnel who had knowledge of past waste disposal techniques and handling methods. Pertinent information collected and analyzed as part of the PA included a records search of the history of the Station; the local geological, hydrological, and meteorological conditions that might influence migration of contaminants; and ecological settings that indicate environmentally sensitive conditions.

C. Scope

The scope was limited to the identification of sites at or under primary control of the Station and evaluation of potential receptors. The PA included:

- an on-site visit during the week of May 29-June 1, 1990;
- acquisition of records and information on hazardous materials use and waste handling practices;
- acquisition of available geological, hydrological, meteorological, land use and zoning, critical habitat, and related data from federal and state agencies;
- a review and analysis of all information obtained; and
- preparation of a summary report to include recommendations for further action.

The subcontractor effort was conducted by the following Science & Technology, Inc. (SciTek) personnel: Mr. Tracy C. Brown, Environmental Analyst; Mr. Charles T. Goodroe, Environmental Protection Specialist; and Mr. Stephen B. Selecman, Geologist/Hydrogeologist. Mr. Richard Hill of the NGB is Project Officer for this Station and participated in the overall assessment during the week of the station visit. Ms. Patricia Franzen of the Hazardous Waste Remedial Actions Program (HAZWRAP) and Ms. Tullete Belford of the NGB also participated in the station visit.

The point of contact (POC) at the Station was Captain Joseph W. Mihalik (Base Civil Engineer).

D. Methodology

The PA began with a visit to the Station to identify all operations that may have used hazardous materials or may have generated hazardous wastes. Figure I.1 is a flow chart of the PA methodology.

Ten past and present Station employees familiar with the various operating procedures were interviewed. These interviews were conducted to determine those areas where waste materials (hazardous or nonhazardous) were used, spilled, stored, disposed of, or released into the environment. The interviewees' knowledge and experience with Station operations averaged 15.9 years and ranged from 2.5 to 32 years.

Records contained in the Station files were collected and reviewed to supplement the information obtained from the interviews.

Detailed geological, hydrological, meteorological, and environmental data for the area were obtained from the appropriate federal, state, and local agencies. A listing of agency contacts is included as Appendix A.

After a detailed analysis of all the information obtained, it was concluded that three sites may be potentially contaminated with hazardous wastes. Under the IRP program, when sufficient information is available, sites are numerically scored using the Air Force Hazard Assessment Rating Methodology (HARM). A description of HARM is presented in Appendix B.

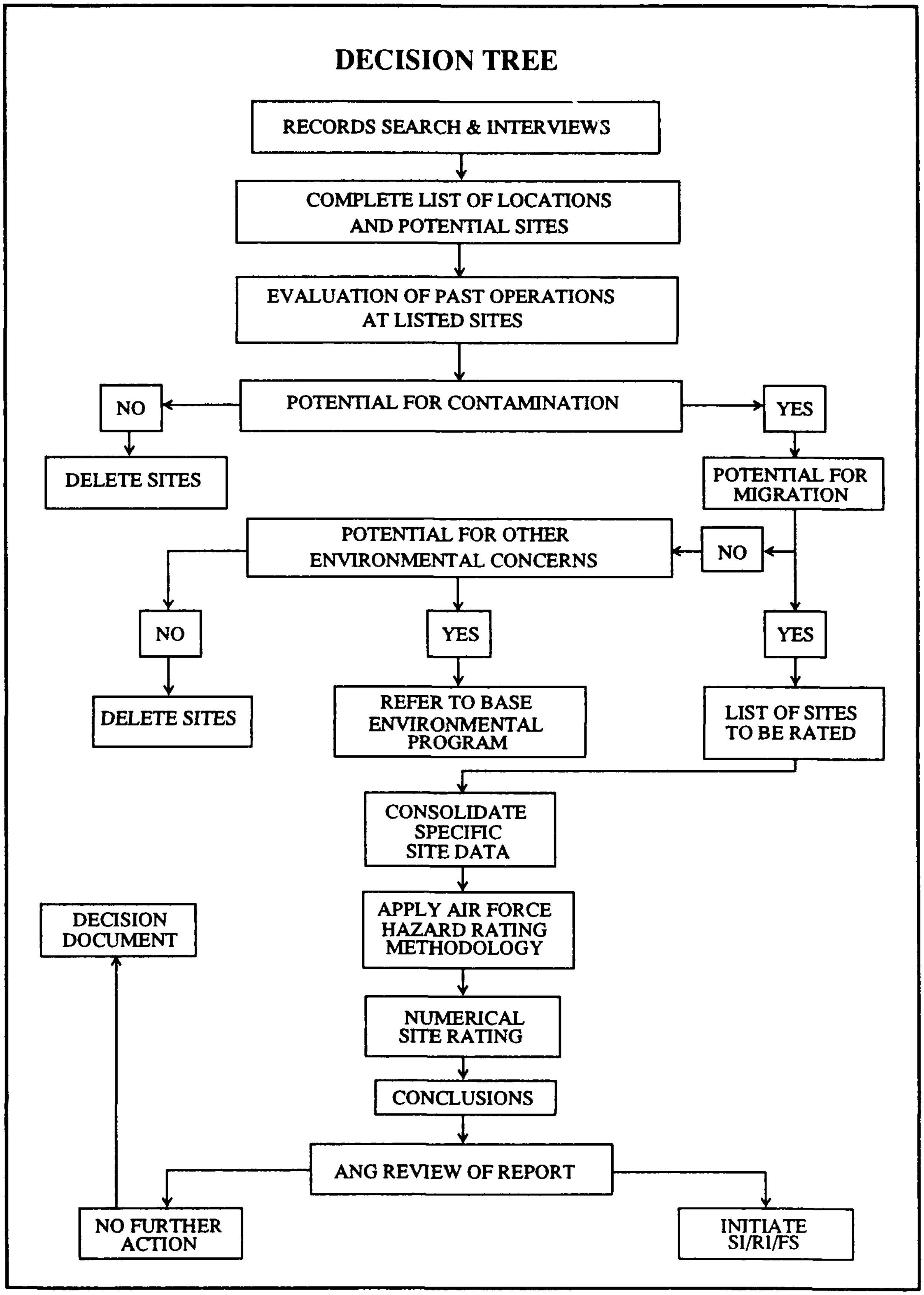


Figure I.1

Preliminary Assessment Methodology Flow Chart

II. INSTALLATION DESCRIPTION

A. Location

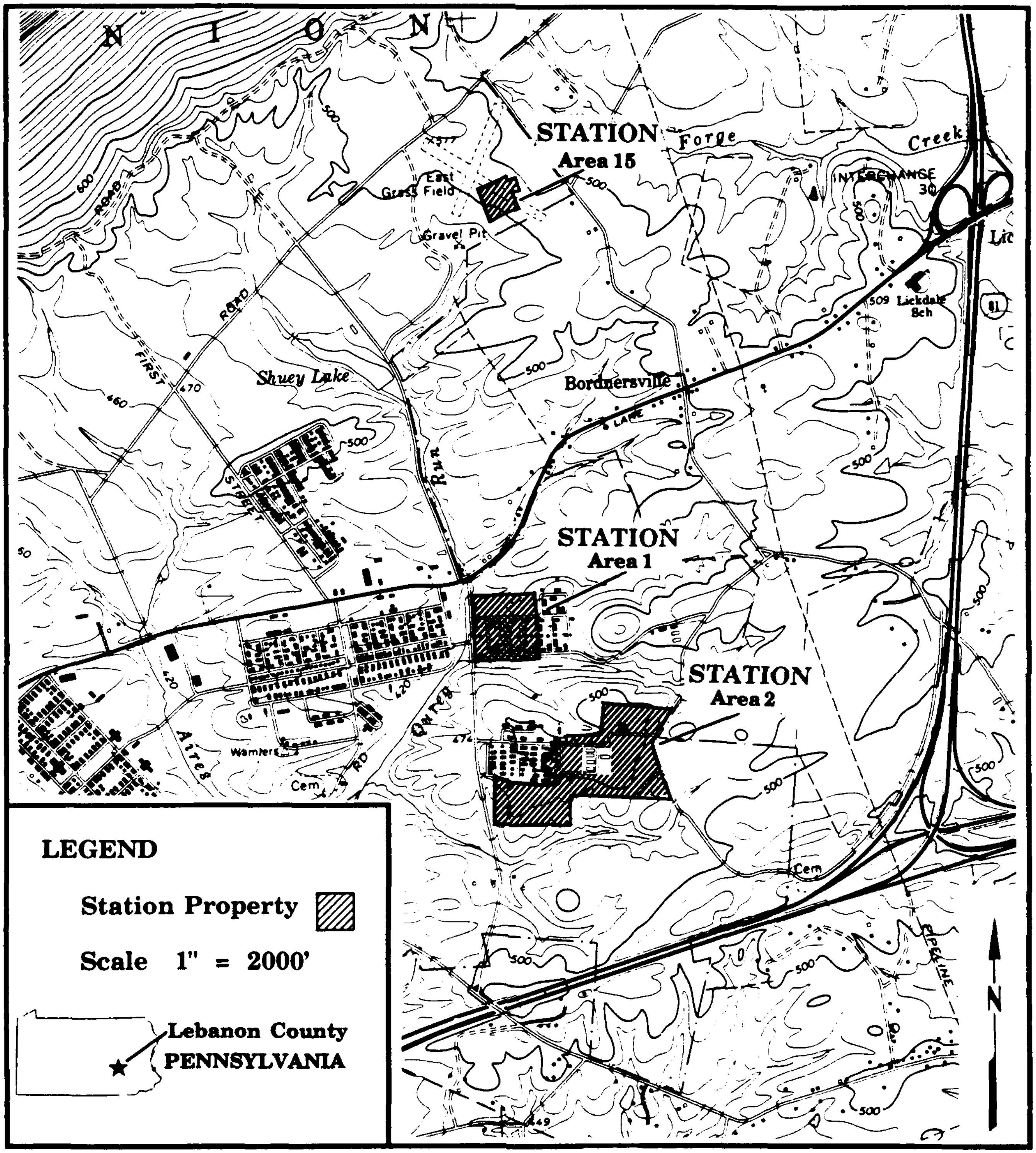
The Station is located approximately twenty miles east of Harrisburg and just north of Interstate Highway 81 in the eastern portion of the Fort Indiantown Gap Military Reservation. The Station consists of four parcels of land, six organizations, and numerous buildings. Elevation of the Station is approximately 430 feet above mean sea level (AMSL). Figures II.1A and 1B illustrate the locations and boundaries of the four areas the Station uses exclusively.

The Station currently occupies four separate areas for a total of 84.6 acres. Area 1 occupies 21.2 acres and houses the 201st RHCEF, 201st REOTS, and the 203rd WF. Area 2 occupies 52.4 acres and houses the 211th EIS and the 271st CCS. Within Area 26, six acres are occupied by the 112th TFG DOMAR, and within Area 15, five acres are used exclusively by the 201st REOTS. The Station could add an additional 16.9 acres if the proposed location for the Combined Headquarters is obtained. The property contains approximately 65 buildings. The major effort of construction on the Station is to maintain the existing facilities. The population of the Station during the week numbers 105 members (including sixteen students of the 201st REOTS). Unit Training Assembly occurs one weekend per month. The Station population during this weekend is 585 members.

B. Organization and History

The original facilities on the Station were constructed during World War II and were occupied by the United States Army. The property currently supports six organizations. Three of the units (201st, 211th, and 271st) are the principal generators of waste products, and the remaining three units produce only nominal amounts. There are four vehicle maintenance and two AGE maintenance activities at the Station.

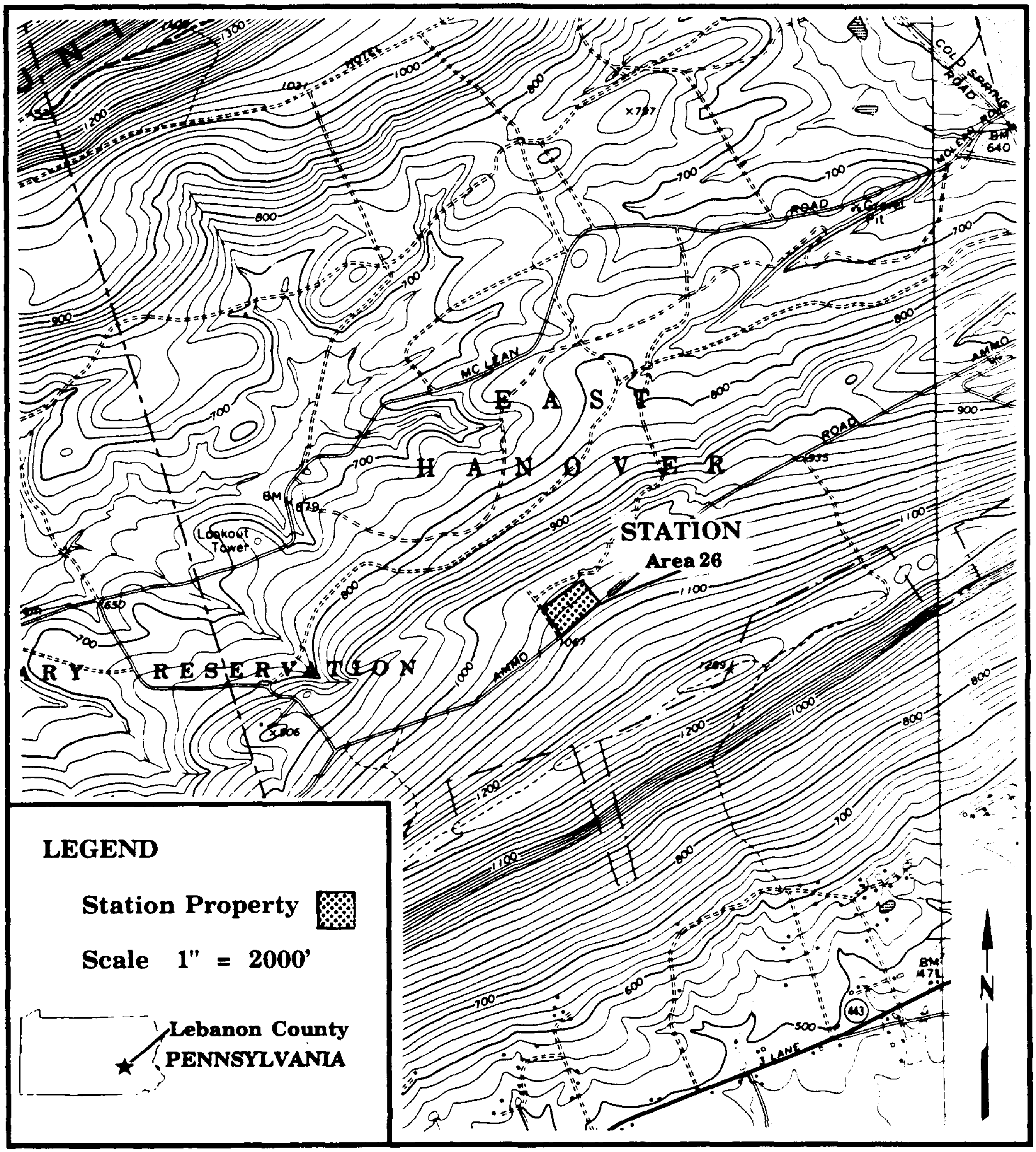
In November 1971, the 201st RHCEF arrived at Fort Indiantown Gap and established the ANG Station. This is the host unit, and it controls all the routine functions of the facility. The mission of the 201st RHCEF is to provide a highly mobile, rapidly deployable civil engineering response which is self-sufficient for limited periods of time. The mission of the RHCEF was created from the need by the Air Force to meet the requirements to repair damage to installations caused by enemy action and to provide additional troop construction support. The mission has not changed over the years. The 201st RHCEF has a vehicle maintenance and an AGE maintenance shop.



SOURCE: USGS, Indiantown Gap, Pennsylvania, 7.5 Minute Series (Topographic), 1969.

Figure II.1A

Location Map of
the Fort Indiantown Gap Air National Guard Station



SOURCE: USGS, Grantville and Indiantown Gap, Pennsylvania, 7.5 Minute Series (Topographic), 1969.

Figure II.1B

Location Map of the Fort Indiantown Gap Air National Guard Station

The 211th EIS was originally activated as the 211th Communications Construction Squadron on August 26, 1953, in New York. Over the years, the unit has experienced several name changes but retained its numerical designation. The 211th EIS arrived at the Station in 1972. The mission of the 211th EIS is to mobilize and deploy authorized resources and supporting assets to accomplish the engineering, installation, reconstruction, and/or replacement of communications-computer systems and tracals. The mission has not changed significantly over the years. The 211th EIS has a vehicle maintenance shop.

The 271st CCS was originally activated as the 322nd Signal Company on August 15, 1942, at Wendover Field, Utah. After numerous changes, it acquired its present designation as a Combat Communications Squadron on April 1, 1976. A small detachment from the 271st CCS arrived at the Station in 1972. In April 1974, the 271st CCS officially took up residence at the Station. The mission of the 271st CCS is to maintain, deploy, and operate tactical communications packages in support of Air Force missions worldwide. The mission has not changed significantly except for improvements in equipment. The 271st CCS has a vehicle maintenance and an AGE maintenance shop.

The aforementioned units are the principal generators of waste materials. The fourth unit which produces wastes (to a lesser degree) is the 112th TFG DOMAR. This unit was created in 1983 with a mission to operate and maintain a bombing range in support of training tactical fighter aircraft of the ANG, reserve, and active Air Forces. The 112th TFG DOMAR has a one-stall vehicle maintenance area at its location in Area 26. This shop has very limited capabilities, and only minor repairs and daily services are performed at this location. Because of assigned assets, the resultant waste materials from operations are very modest. The disposition of these wastes are the same as the other units on the Station.

A need existed to tailor the training requirements for the ANG. In 1987, the 201st REOTS was established to provide this specialized training within the region. In 1989, the school expanded its charter to provide this training to all active, reserve, and National Guard Civil Engineering units. The goal of the REOTS is to improve Air Force Civil Engineering's wartime capabilities by providing pavement and equipment personnel with hands-on experience with key Rapid Runway Repair equipment items. The school operates on a weekly cycle and has 16 students per class. During the week, cadre and equipment assets are obtained from the 201st RHCEF. Equipment maintenance is performed by the 201st RHCEF. This unit produces no hazardous waste material.

In 1979, the 203rd WF arrived at the Station. The unit consists of one individual during the week and a total of 19 members during the training weekend. The mission of the 203rd WF is to provide all requested weather support to the ground and air forces of the 28th Infantry Division to include observations, forecasts, severe weather advisories, climatological information, and solar/lunar data. This unit produces no hazardous waste materials.

The units with motor vehicle and/or AGE maintenance shops are the primary generators of waste materials on the Station. A summary of the types of wastes generated can be found in Chapter IV.

The property has supported functions of the military since the 1940s. This may or may not have included a maintenance activity on the present Station property. The repair and servicing of motor vehicles and AGE items have taken place on the property by the assigned units over the past 19 years. There are approximately 35 underground storage tanks (USTs) for heating oil. Each vehicle maintenance area (in Area 1 and Area 2) has a refueling area and has USTs for diesel and automotive gasoline (MOGAS) fuels. Each of these areas has two oil/water separators (OWSs) which aid in the prevention of water and property degradation. Reports indicate that the OWSs are inspected every six months and are cleaned as necessary. Waste products are stored in 55 gallon drums for disposal through proper channels.

Materials recognized as hazardous have been generated on this property since the establishment of the Station in 1971. With the awareness of hazardous materials and the recognition of their impact on the environment, acceptable disposable practices and procedures have evolved. The majority of hazardous wastes are now collected and disposed of through contractors and the Defense Reutilization and Marketing Office (DRMO).

III. ENVIRONMENTAL SETTING

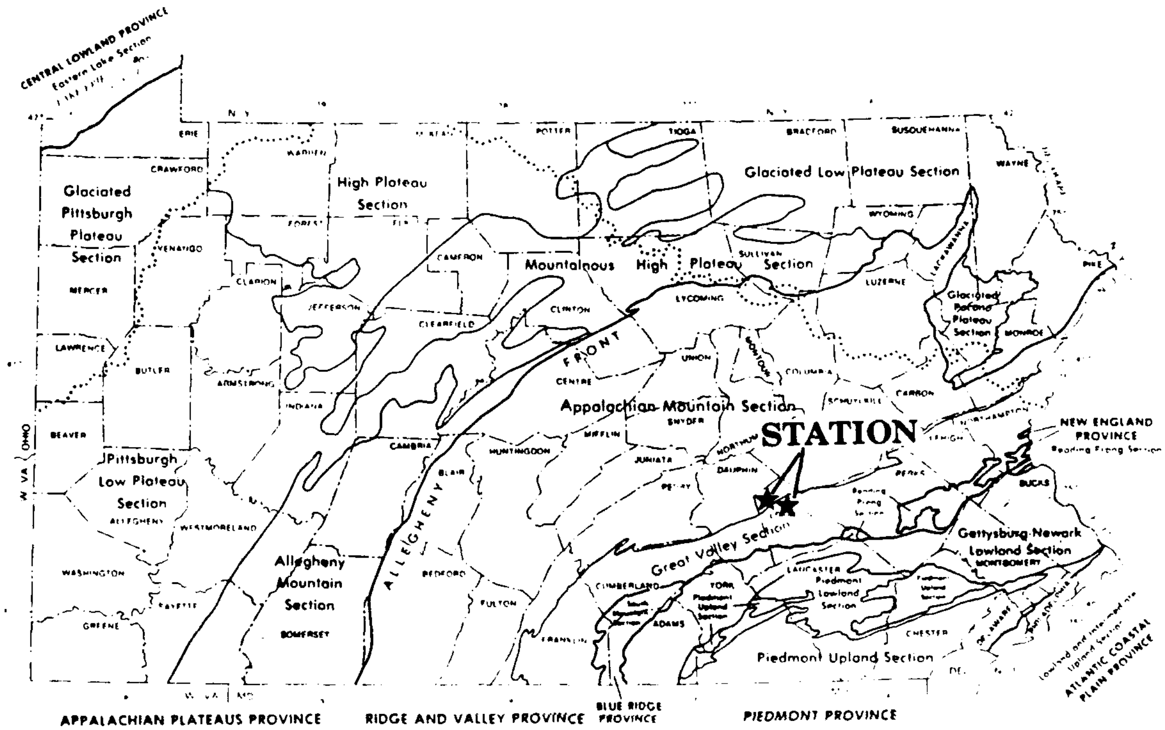
A. Meteorology

The following climatological data is largely derived from the National Climatic Data Center, Ashville, North Carolina, and is published in the Soil Survey of Lebanon County, Pennsylvania (United States Department of Agriculture (USDA): Soil Conservation Service, 1981). Lebanon County is characterized by a humid continental climate. The average annual precipitation is 42.30 inches and is distributed fairly evenly throughout the year with the winter receiving slightly less than the other seasons. The amount of annual precipitation varies within the county because of the orographic effects produced by the Appalachian Mountains. Annual precipitation is greatest in the northern part of the county and generally decreases to the south. Based on 78 years of data (1883-1961), the Station receives an average of 45 to 46 inches of precipitation per year (Stuart et al, 1967). Precipitation ranges from an average monthly low of 2.47 inches in February to an average monthly high of 4.42 inches in May. By calculating net precipitation for the Station according to the method outlined in the Federal Regulations CERCLA Pollution Contingency Plan (United States Environmental Protection Agency, 55 FR 8813, Subpart K, March 8, 1990), a net precipitation value of approximately 14 inches is obtained. The one-year, 24-hour rainfall for the area is approximately 2.5 inches. Thunderstorms occur on an average of 37 days each year, mostly in the summer. Snowfall is light to moderate and averages approximately 36 inches per year. At least one inch of snow covers the ground on an average of 50 days per year.

Winters are generally cold, and summers are mild. The average annual temperature is about 51.6°F, and the mean summer and winter temperatures are 76.0°F and 32.0°F, respectively. The prevailing wind direction is from the northwest in the winter and from the west in the summer. Wind speed is highest in the winter at 12 mph and averages 10 mph annually.

B. Geology

Lebanon County is located in the Appalachian Valley and Ridge and the Piedmont physiographic provinces (Figure III.1). The southern-most part of the county occurs in the Piedmont province while the remainder of the county is located in the Valley and Ridge province, which is further divided into the Great Valley and Appalachian Mountain sections. The northern extreme of Lebanon County exists in the Appalachian Mountain section while the central two-thirds of the county is located in the Great Valley section. The Station is situated along Blue Mountain which represents the geographic boundary between the Appalachian Mountain section and the Great Valley section. Areas 1, 2, and 15 of the Station property are located south of Blue Mountain



LEGEND

Physiographic Sections and Provinces in the State of Pennsylvania

Scale

0 50 mi.

N

SOURCE: Pennsylvania Geologic Survey, Physiographic Province Map of Pennsylvania, Map 13, 1989.

Figure III.1

Physiographic Map of Pennsylvania

and exist in the Great Valley section. Area 26 is located on the northwest slope of Blue Mountain and occurs in the Appalachian Mountain section.

The Appalachian Mountain section is characterized by a series of alternating narrow ridges and valleys that have a northeast to southwest orientation. The bedrock is chiefly composed of Middle-Paleozoic age clastics, and the more weather resistant rocks form the ridge tops while the less resistant rocks comprise the valley floors and mountain sides. Topographic relief in the Appalachian Mountain section is high with surface elevations ranging from in excess of 1600 feet AMSL on mountain tops to around 500 feet AMSL in the valley floors in Lebanon County. The surface elevation at Area #26 along the northwest slope of Blue Mountain is approximately 1060 feet AMSL.

The Great Valley section is characterized by a broad lowland area that has been moderately dissected by fluvial erosion. Bedrock largely consists of Lower Paleozoic age carbonates and shales. Primarily, Ordovician age shales and sandstones compose the bedrock in the northern part of the section while Ordovician and Cambrian age carbonates occupy the southern one-half of the Great Valley (Royer, 1983). Topographic relief is low to moderate with surface elevations ranging from 420 feet to 500 feet AMSL in the vicinity of Areas 1, 2, and 15 of the Station property. The topography here gently slopes southeast from Blue Mountain toward Swatara Creek.

The geology of the Valley and Ridge province is complex. Regional compressional forces from the southeast during the Late Paleozoic Era produced a network of folds and faults that are the dominant structural features of the Great Valley and the Appalachian Mountains section. As a result of the southeast-oriented compressional forces, the general regional structural grain is northeast to southwest, and formations generally dip to the south (Carswell et al, 1968). The Appalachian Mountain section is dominated by open and closed plunging folds which have planar limbs and narrow hinges. Thrust faults and normal faults are predominant along with strike-slip faults which have been mapped extensively in Lebanon County (Mosley, 1954, and Bricker, 1960). The Great Valley section is characterized by thrust sheets, nappes, overturned folds, and steep faults (Pennsylvania Geological Survey, 1989).

The carbonate rocks found in the southern one-half of the Great Valley in Lebanon County occur as part of an overturned recumbent synclinorium (Geyer et al, 1958, and Gray et al, 1958). Carbonate formations that crop out in this complex become progressively younger from south to north. The northern part of the Great Valley in Lebanon County is composed of shales and sandstones that are described as lithotectonic units of the Hamburg sequence. The Hamburg sequence is complex in both depositional and structural occurrence (Royer, 1983). Kay, 1941, suggested the Hamburg sequence to be allochthonous, and many others have since supported this theory. Strose, 1946, named this sequence the Hamburg Klippe.

Deposition of the Hamburg sequence occurred far to the east or southeast from its present location (Epstein et al, 1972). Carswell et al, 1968, reported that the members of the sequence were deposited at least 20 miles southeast or south from their current location in the Harrisburg area. Following their deposition, the lithotectonic units of the Hamburg sequence were probably stacked in their present order by gravity sliding or thrust faulting. After the postdepositional repositioning of the units, they were then thrust faulted as a single complex to the northwest to their current position on top of the Martinsburg formation (Wood and MacLachlan, 1978).

Areas 1, 2, and 15 of the Station property are underlain by the northerly most occurrence of the Hamburg sequence known as lithotectonic unit 1 which is described as a olive-weathering gray shale and is interbedded with gray and brown calcareous graywacke (Figure III.2A). The thickness of lithotectonic unit 1, as well as the other lithotectonic units, is not known (Royer, 1983). Immediately northwest of Area 15, lithotectonic unit 1 is in contact with the Martinsburg formation which crops out along the southeast slope of Blue Mountain (Figure III.3). The exact location of the contact is not known but it is mapped (Royer, 1983) as occurring approximately 0.20 miles northwest from Area 15. South of Area 2, lithotectonic unit 1 is in contact with other members of the Hamburg sequence described as lithotectonic units 2 and 3 (Royer, 1983). These contacts are mapped (Royer, 1983) as existing approximately 0.65 and 0.35 miles from Area 2, respectively. A lithologic description for the entire Hamburg sequence and the adjoining Martinsburg formation can be found in Figure III.2A. Area 26 of the Station property, which is located along the northwest slope of Blue Mountain, is underlain by younger rocks of Upper Silurian and Middle Devonian age. Specifically, the Silurian age Bloomsburg formation is mapped (Royer, 1983) as occupying the southern one-half of the property and the Devonian age Mahantango formation in the northern one-half. The basic lithology of these formations is shale, siltstone, and sandstone (Figure III.2B), and the aggregate thickness is approximately 3375 feet (Royer, 1983).

The soils overlying the bedrock at Areas 1, 2, and 15 of the Station property are members of three general soil types: the Berks, Conly, and Weikert soils. The basic composition of these soil classifications is a shaley silty or silty loam, and each soil type is common to a dissected upland valley topography which is characteristic of these specific areas. Area 1 is underlain by soils of the Berks group. Specifically, the northern one-fifth of the property is composed of the Berks shaley silty loam (BkC), and the remainder of Area 1 consists of a derivative of the Berks group, named the Urban land-Berks complex (UR). The BkC unit is a gently sloping, moderately deep, well-drained soil with moderate (0.63 to 2.00 inches per hour or 4.45×10^{-4} to 1.41×10^{-3} cm/sec) to moderately rapid (2.00 to 6.00 inches per hour or 1.41×10^{-3} to 4.24×10^{-3} cm/sec) permeability. Depth to bedrock for the BkC soils is generally 33 inches. The UR soils are Berks soils that have been modified through urban development. Specific properties and composition cannot be determined without

	Sequence	Geologic Unit	Character of Strata	Water-bearing Characteristics
Upper Cambrian(?) to Upper Ordovician	Hamburg (These lithotectonic units are in probable order of emplacement and may be in reverse order of age.)	Yellow Breeches Thrust Plate	Dark-gray shale with minor interbeds of argillaceous sandstone, red shale, and limestone.	Median yield of domestic wells is 5 gpm. Excessive concentrations of manganese are a common problem. Many wells will require supplemental storage to meet minimum water-supply needs.
		Lithotectonic Unit 8	Olive-weathering gray shale and brick-red shale with minor beds of fine-grained brown argillaceous sandstone, quartzitic sandstone and limestone.	Median yield of domestic wells is 15 gpm. Yield of nondomestic wells is 50 gpm.
		Lithotectonic Unit 6	Greenish-brown siltstone and argillaceous sandstone and shale, with interbeds of maroon shale, sandstone, limestone.	Median yield of domestic wells is 12 gpm. Median nondomestic yield in Berks County is 140 gpm. Very low yields are obtained from igneous and metamorphic rocks.
		Lithotectonic Unit 4	Black and orange-weathering laminated shale, quartzite, and thin- to medium-bedded sandy limestone.	Median yield of domestic wells is 15 gpm. Median nondomestic yield is 62 gpm.
		Lithotectonic Unit 3	Interbedded red siltstone and shale, olive siltstone and shale, siliceous shale, and minor beds of chert and quartzitic sandstone.	Median yield of domestic wells is 20 gpm. Median yield of nondomestic wells is 58 gpm.
		Lithotectonic Unit 2	Interbedded limestone and micaceous shale and siltstone; massively bedded calcarenite often associated with limestone. Limestone conglomerate and red shale are also present minor amounts.	Median yield of domestic wells is 15 gpm. Nondomestic yields reported for two wells were 400 and 500 gpm.
		Lithotectonic Unit 1	Olive-weathering gray shale and graywacke.	Median yield of domestic wells is 15 gpm. Median yield of nondomestic wells is 17.5 gpm.
		Hamburg Sequence Rocks, Undifferentiated	Gray, dark-gray, and greenish gray phylittic shale and silty argillite.	Too few dates are available to evaluate water-bearing properties of this rock unit.
Upper Ordovician	Lebanon Valley	Martinsburg Formation	Gray to dark-gray, buff-weathering shale.	Median yield of domestic wells is 17.5 gpm. Median water hardness is 68 mg/L
		Hershey Formation	Dark-gray argillaceous limestone.	Poorly permeable aquifer. Median yield of domestic wells is 22 gpm. Very hard water.
		Myerstown Formation	Gray, crystalline, thin-bedded limestone, graphitic at base.	Too few data are available to evaluate the water-bearing properties of this rock unit. Median yield of domestic wells in Berks County is 20 gpm. Very hard water.

SOURCE: Royer, D. W., Summary Groundwater Resources of Lebanon County, Pennsylvania, Pennsylvania Geologic Survey, 1983.

Figure III.2A

Generalized Stratigraphic Column of Areas 1, 2, and 15

System	Geologic Unit	Character of Strata	Water-bearing Characteristics
Mississippian	Mauch Chunk Formation	Interbedded grayish-red sandstone, siltstone, and shale.	Data not available: in adjacent counties formation yields moderate to large quantities of good-quality water to public suppliers and industry.
	Pocono Formation	Light-gray to buff, medium-grained, crossbedded sandstone and some interbedded siltstone; commonly conglomeratic at base and in middle.	Minimum data available; probably yields good-quality water in quantities adequate for domestic supply.
	Spechty Kopf Formation	Light- to olive-gray, crossbedded sandstone and fine- to medium-grained siltstone.	Not tapped by wells; yields would probably be small due to high topographic position.
Upper Devonian	Catskill Formation	Succession of grayish-red sandstone, siltstone, claystone, and minor conglomerate, generally in fining-upward cycles.	Water is generally soft, occasionally high in iron, and in quantities adequate for domestic supply.
	Trimmers Rock Formation	Olive-gray siltstone and shale, characterized by graded bedding.	Median yield of domestic wells is 9 gpm. Water is soft, has a low pH value, and is thus potentially corrosive to metal plumbing.
Middle Devonian	Mahantango Formation	Gray, brown, and olive shale and siltstone.	Too few data are available to evaluate the water-bearing properties of this rock unit. The hardness of water from one well is 17 mg/L.
Lower Devonian	Onondaga Formation Through Poxono Island Formation, Undivided	Gray calcareous sandstone and shale interbedded with limestone and dolomite.	Data not available; limited areal extent.
Upper Silurian / Lower Silurian	Bloomsburg Formation	Grayish-red siltstone, shale, and sandstone arranged in fining-upward cycles.	Data not available; median nondomestic yield in Schuykill County is 130 gpm.

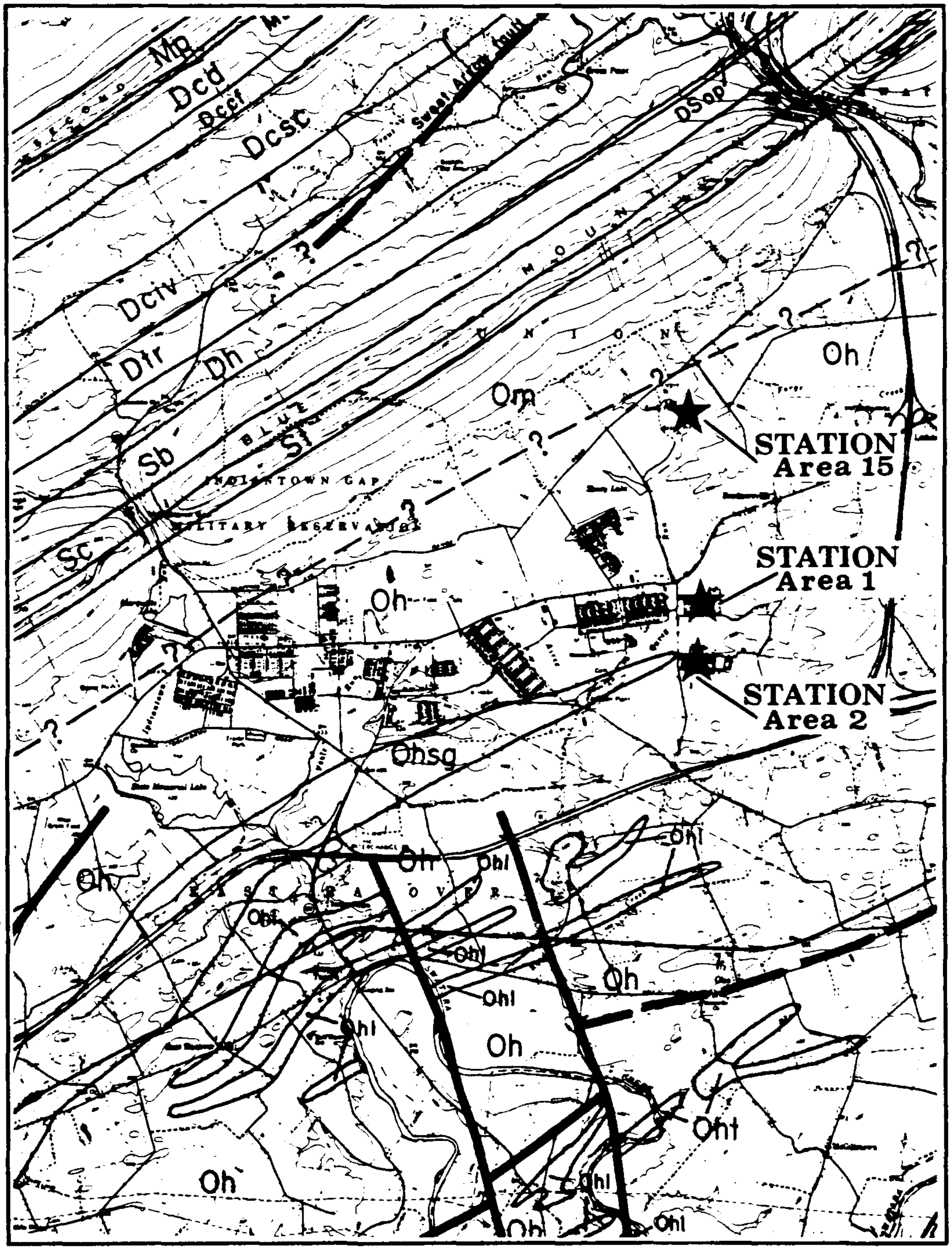
SOURCE: Royer, D. W., Summary Groundwater Resources of Lebanon County, Pennsylvania, Pennsylvania Geologic Survey, 1983.

Figure III.2B

Generalized Stratigraphic Column of Area 26

LEGEND

Pl
Llewellyn Fm.
Pp
Pottsville Fm
Mmc
Mauch Chunk Fm
Mp
Pocono Fm.
MDsk
Spechty Kopf Fm.
Dcd
Duncannon Mbr.
Dccf
Clark's Ferry Mbr.
Ocsc
Sherman Creek Mbr.
Dciv
Irish Valley Mbr.
Catskill Fm.
Dtr
Trimmer's Rock Fm.
Dh
Hamilton Gp.
Dsop
Onondaga Fm. through Poxono Isl. Fm., indiv.
Sb
Bloomsburg Fm.
Sc
Clinton Gp.
St
Tuscarara Fm.
Om
Martinsburg Fm.
HAMBURG SEQUENCE
Oh
Hamburg Sequence rocks, phyllitic shale
Ohag
Hamburg Sequence rocks, shale and graywacke
Ohg
Hamburg Sequence rocks, graywacke
Ohl
Hamburg Sequence rocks, limestone
Od
Metadiabase



Formation Contacts Faults
Dashed where inferred

SOURCE: Indiantown Gap 7.5 Minute Quad, Atlas of Preliminary Geologic Quadrangle Maps of Pennsylvania, Map #61, 1981.

Figure III.3

Surficial Geologic Map of Areas 1, 2, and 15

a detailed investigation of their occurrence. It should be noted that abundant amounts of shale are visible at the surface in the areas of occurrence of the UR soils at the Station. The abundance of shale likely indicates the removal of much of the pre-existing Berks soil resulting in a very shallow UR soil.

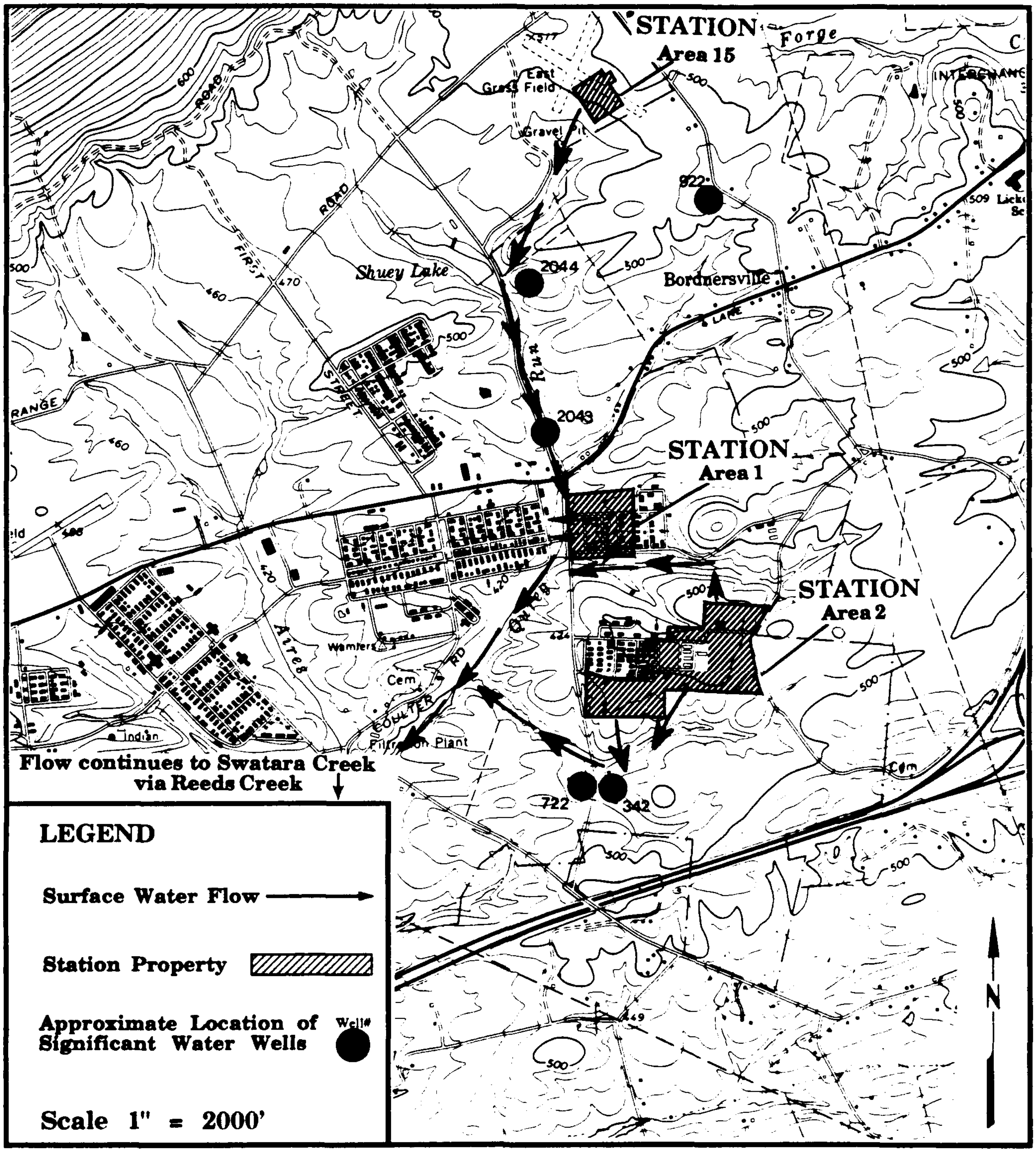
Area 2 of the Station property largely consists of soils from the Berks and Weikert groups; however, a small area is composed of soils from the Conly group. The northwest one-third of Area 2 is comprised of the UR soil unit. The remaining two-thirds of the property consists primarily of the Weikert shaley silt loam soils (WeB and WeD), with a small area of BkC and Conly silt loam (CmB) along the eastern boundary. WeB and WeD soil units are of similar composition and have like characteristics. They differ only in the degree of associated slope. The WeB is associated with gentle slopes and the WcD with moderately steep slopes. Both soil units are shallow, well-drained, and have moderately rapid permeability (2.00 to 6.00 inches per hour or 1.41 x 10^{-3} to 4.24 x 10^{-3} cm/sec). The depth to bedrock averages 17 inches. The CmB soil unit is a gently sloping, deep, moderately well drained soil with moderate permeability (0.63 to 2.00 inches per hour or 4.45 x 10^{-4} to 1.41 x 10^{-3} cm/sec). In addition, Area 15 of the Station property is solely underlain by the WeB soil unit.

Area 26 of the Station property is underlain by the Buchanan extremely stony loam (BxB) soil which is common to colluvial foot slopes at the base of the mountains. The BxB soil is typically gently sloping, moderately well drained to poorly drained, and occurs to a depth of 60 inches. Surface runoff is medium, and the depth to the water table is very shallow during the wet season. The soil is classified as having slow permeability (0.06 to 0.20 inches per hour or 4.24 x 10^{-5} to 1.41 x 10^{-4} cm/sec). The information pertaining to soils in this text was obtained from the Soil Survey of Lebanon County, Pennsylvania (United States Department of Agriculture (USDA): Soil Conservation Service, 1981).

C. Hydrology

1. Surface Water

The Station is located in the Swatara Creek drainage basin. Swatara Creek drains 576 square miles and is the largest tributary of the Susquehanna River (Stuart et al, 1967). Surface runoff from Areas 1, 2, and 15 of the Station is transported to Swatara Creek via Qureg Run which is located immediately west of each area (Figure III.4A). Qureg Run flows south from the Station where it joins with Aires Run and Reeds Creek before emptying into Swatara Creek which is approximately 3 miles downstream from Area 2. Surface runoff from Area 26 is transported west from the property by the headwaters of Manada Creek. This creek flows west approximately 3.2 miles before turning south and flowing through Manada Gap at Blue Mountain and continuing



SOURCE: USGS, Indiantown Gap, Pennsylvania, 7.5 Minute Series Topographic, 1969.

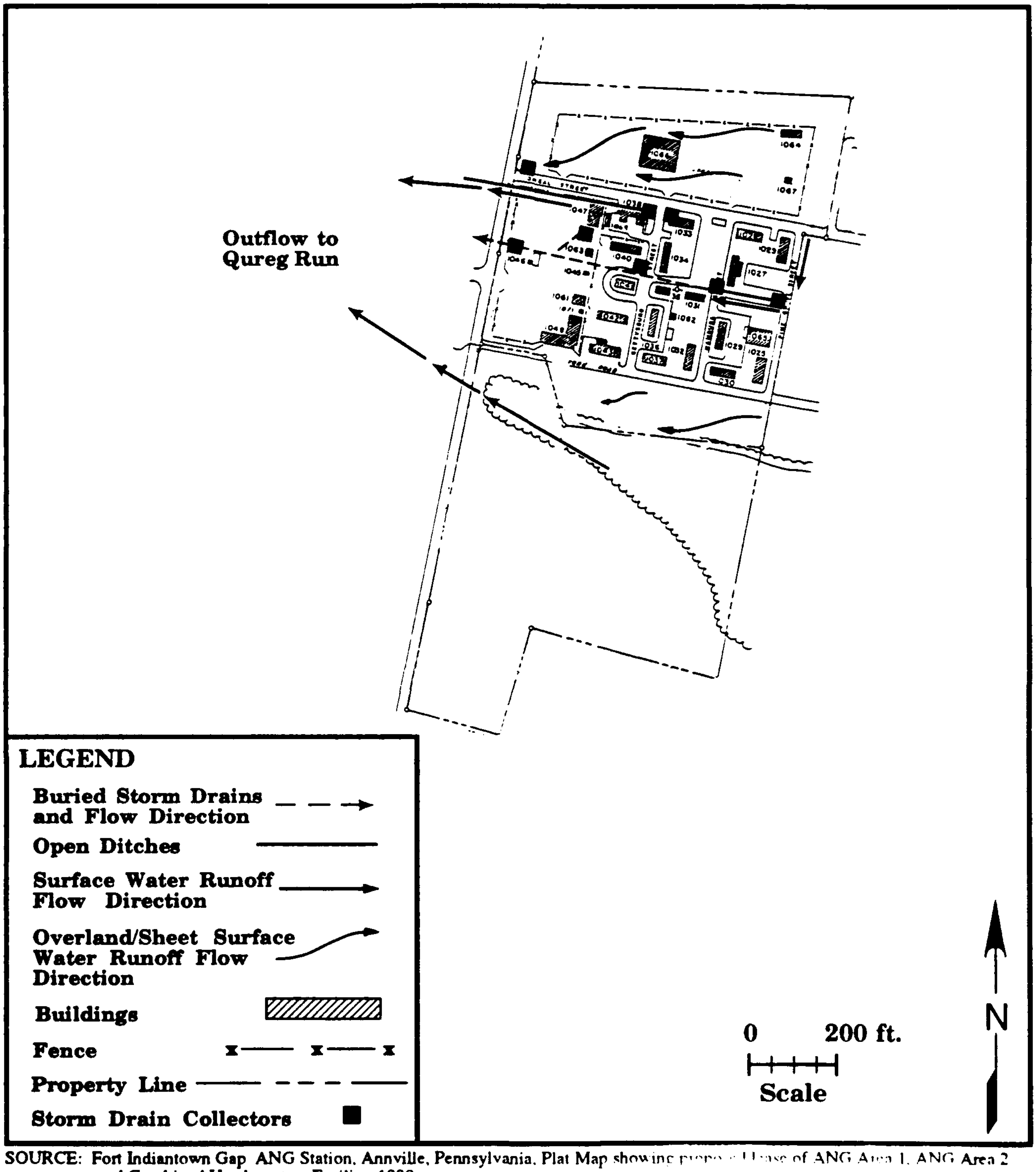
Figure III.4

Surface Runoff Flow Route Map for Area Surrounding Station

approximately 8 miles to Swatara Creek. Swatara Creek flows in a general southwesterly direction from Reeds Creek and Manada Creek to empty into the Susquehanna River 5 miles south of Harrisburg. The Station areas are located outside the 100-year flood plain (Federal Emergency Management Agency, 1979).

Surface runoff from Areas 1, 2, and 15 of the Station property is collected separately and transported to Qureg Run. Area 1 is drained by a series of ditches and overland flow routes which transport surface runoff to outflow points situated along the west and southwest boundary of the property (Figure III.5A). The northern one-third and the southern one-third of Area 1 are drained by overland flow routes. Overland flow is collected and outflows the property at common points located along the northwest and southwest sides of the areas, respectively. The central one-third of Area 1 is drained by a series of ditches and underground storm drains. Here, surface runoff is westward to an outflow point located along the western boundary. All of the surface runoff exiting Area 1 through these three outflow points is transported under Quartermaster Road where it empties directly into Qureg Run.

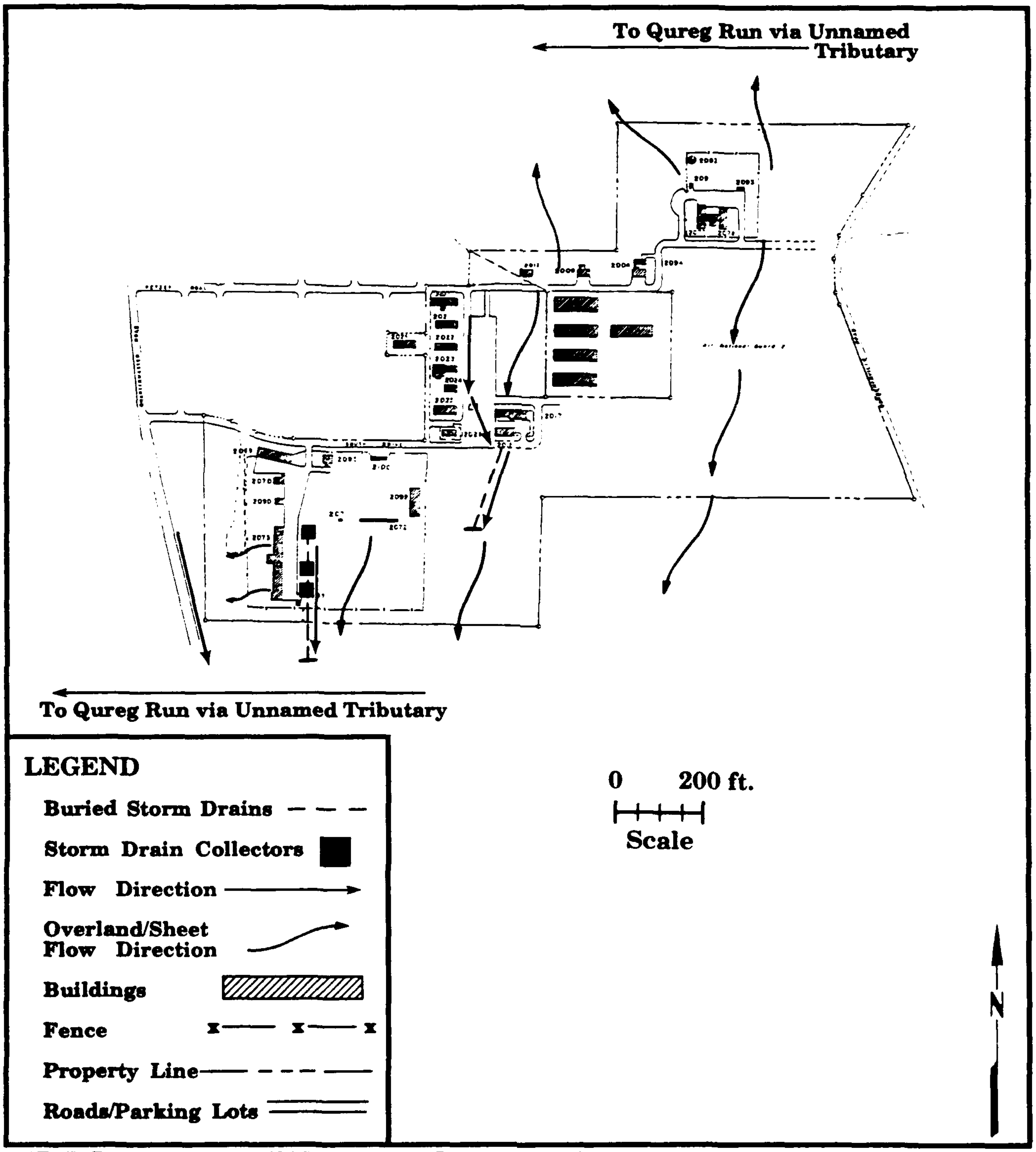
Surface runoff drainage for Area 2 is more complex because of its larger size and incomplete drainage maps. The northern one-fourth of Area 2 drains surface runoff overland to the north where in outflows the property (Figure III.5B). After exiting Area 2, the surface runoff is collected in a unnamed tributary and transported west approximately 0.5 miles to Qureg Run. In the southern three-fourths of Area 2, surface runoff flows south overland and through a series of ditches and buried storm drains. Two storm drainage systems exist on Area 2, and they are designed to drain the central and southwest parts of the area. The southwestern drainage system is located in the vehicle maintenance area. This system consists of three storm drains to collect overland flow from the east side of Building 2073 and transport it south to outflow the property outside the southern boundary. The second storm drainage system is located in the central part of Area 2 where it uses catch basins to collect overland flow. Surface runoff is then transported south through a buried storm drain to a point outside of the building complex where it is released onto the ground. Flow continues south overland where it outflows Area 2 along the southern boundary. Little detail can be given concerning the above drainage system because no formal records are available which denote its exact location and design. The remainder of Area 2 is drained via overland flow to the south where surface runoff outflows the property along the southern boundary. All surface runoff exiting the southern boundary of Area 2 is collected in an unnamed tributary and flows west 0.6 miles under Quartermaster Road to Qureg Run.



SOURCE: Fort Indiantown Gap ANG Station, Annville, Pennsylvania. Plat Map showing [illegible] Phase of ANG Area 1, ANG Area 2 and Combined Headquarters Facility, 1989.

Figure III.5A

Drainage Map of the Fort Indiantown Gap Air National Guard Station - Area 1



SOURCE: Fort Indiantown Gap ANG Station, Annville, Pennsylvania, Plot Map showing proposed lease of ANG Area 1, ANG Area 2 and Combined Headquarters Facility, 1989.

Figure III.5B

Drainage Map of the Fort Indiantown Gap Air National Guard Station - Area 2

2. Groundwater

The occurrence and movement of groundwater in Lebanon County is largely governed by the existence and the degree of development of secondary porosity and permeability in the bedrock. Secondary porosity and permeability is primarily associated with fracturing of the bedrock. Fracturing is widespread and can be attributed to the extensive structural deformation associated with the region. Consequently, groundwater can be found to occur in usable quantities at almost any location in Lebanon County. The principal water-bearing units in Lebanon County are the carbonate rocks that occupy the southern and central part of the Great Valley, the shale formations that are located to the north, and the Triassic age clastics that exist to the south. The carbonate formations have the highest and most reliable water yields in the county, followed by the Triassic age clastics and then the shale formations (Royer, 1983). With regard to the Station, the shale formations are of primary importance because they underlie each of the Station properties.

The shale formations contain very little primary porosity and permeability because of the lack of pore spaces resulting from the small particle size, cementation, and compaction of the shales. Therefore, the occurrence of groundwater and the ability of the shales to function as a water-bearing unit is dependent on the development of secondary porosity and permeability. Secondary porosity and permeability is created by fracturing of the shale formations through structural deformation. Fracturing occurs in association with faults, folds, and joints within the bedrock. Consequently, larger occurrences of groundwater and higher water well yields can be projected in association with geologic features. Topographic features such as valleys, depressions, and lineations can be keys in identifying high water yield areas because of their relationships to structural features (Royer, 1983). However, outside of isolating general areas of the probable occurrence of fracturing, determining the amount of fracturing at a specific location is not possible.

The number and size of the fractures that occur decreases with increased depth, and fractures are thought to become laterally discontinuous at depth (Carswell et al, 1968). This is theorized as being associated with the decline in solvent action of the groundwater on bedrock at depth. It is postulated that the loss of solvent action is related to the slowing of groundwater circulation at depth. Circulating groundwater is thought to be responsible for the subsequent enlargement of the existing fractures through the dissolution of the adjacent soluble bedrock (Carswell et al, 1968). The process of fracture system enlargement through dissolution is more effective in calcareous shales and most effective in the carbonate bedrock which exists south of the Station. The larger occurrences of groundwater and higher water well yields correspond with the location of the fracture systems at shallow depths. Higher yielding water-bearing zones have been reported as deep as 398 feet below the land surface in the Hamburg sequence, but it is not likely that significant water yields will exist below 300 feet to 400 feet (Royer, 1983). Wells #342 and #722 located

immediately south of Area 2 (Figure III.4) found water-bearing zones at 53 feet and 76 feet below the land surface.

The Station properties are located in an area where Stuart et al, 1967, classifies water well yields as poor and estimates yields to range between 10 and 50 gallons per minute (GPM). Royer, 1983, estimates a median domestic well yield of 15 GPM for the lithotectonic unit 1. An average yield of 14.3 GPM was calculated for the wells located in close proximity to the Station (Figure III.4).

The fractured shale is considered to be an unconfined water-bearing unit, and groundwater exists primarily under water table conditions. However, semi-artesian conditions do occur (Caswell et al, 1968). As a result of the fractured and unconfined nature of the shale, recharge of the groundwater takes place locally from precipitation and surface runoff. Based on static water level data collected from adjacent water wells, the average depth to the water table is estimated at 15 feet to 20 feet below the land surface for Areas 1, 2, and 15. The depth to the water table may be less for Area 26 because of its differing geographic position. Regional or deep groundwater movement is interpreted from topography as being in a southerly direction toward Swatara Creek in the vicinity of Areas 1, 2, and 15 of the Station property. However, shallow localized groundwater movement in these areas is inferred from topography as being in a westerly direction toward Qureg Run. Groundwater movement at Area 26 most likely occurs in a northwesterly direction from Blue Mountain toward Manada Creek.

The nearest significant water wells with respect to Station Areas 1, 2, and 15 are shown on Figure III.4. Available information indicates these wells were drilled for domestic purposes and water yields are not sufficient for public supplies. According to information obtained from the Station, wells #342 and #722 have been abandoned for several years. The Station receives its water from the city of Lebanon, Pennsylvania, public water supply system.

The susceptibility of groundwater to contamination from the Station, should a release occur, is considered to be moderate. This conclusion stems from the fractured nature of the bedrock and the corresponding recharge of the water table from local precipitation and surface runoff sources. Although adjacent measured water well yields do not indicate the existence of excessive fracturing in the Station area, the history of structural deformation of the area suggests a reasonably extensive fracture system most likely exists.

D. Critical Habitats/Endangered or Threatened Species

According to current records maintained by the Pennsylvania Game Commission, Pennsylvania Fish Commission, and Pennsylvania Natural Diversity Inventory (Bureau of Forestry - Forest Advisory Services), no

endangered or threatened species of flora or fauna have been identified within a 1-mile radius of the potential sites at the Station. There are no designated critical habitats in this area. However, numerous small wetland areas are located within this area [United States Fish and Wildlife Service, National Wetlands Inventory Map (Fort Indiantown Gap, Pennsylvania Quadrangle)].

IV. SITE EVALUATION

A. Activity Review

A review of Station records and interviews with personnel were used to identify specific operations in which the majority of hazardous materials and/or hazardous wastes are used, stored, processed, and disposed. Table IV.1 provides a history of waste generation and disposal for operations conducted by shops at the Station. If an item is not listed on the table on a best-estimated basis, that activity or operation produces negligible (less than 1 gallon/year) waste requiring disposal.

The potable water supply for Area 1 and Area 2 is municipal water provided by the city of Lebanon. The 26-139 OPS Facility/Compound in Area 26 obtains its potable water from a well located at the compound. A potable water supply is not connected to the REOTS in Area 15.

The buildings in Area 1 and Area 2 are connected to the sanitary sewer system that serves much of the greater Fort Indiantown Gap Military Reservation. Waste water flowing through this system is treated at the U.S. Army's waste water treatment plant, which is located on the reservation and adjacent to Swatara Creek. The treated waste water is released into Swatara Creek. Sewage from the 26-139 OPS Facility/Compound flows to a subsurface sewage disposal facility located about 40 feet northeast of the compound fence. Portable sanitation facilities are used in the REOTS area.

B. Disposal/Spill Site Information, Evaluation, and Hazard Assessment

Ten people were interviewed to identify and locate potential sites that may have been contaminated by hazardous wastes as a result of past Station operations. Three potentially contaminated sites were identified through the interviews. These sites were visually examined in the field.

Each of these sites was rated by application of the United States Air Force (USAF) HARM (Appendix B), and since the potential for contaminant migration exists at these three sites, each is recommended for further investigation under the IRP program. Copies of completed HARM forms and an explanation of the factor rating criteria used for site scoring are contained in Appendix C.

The potential exists for contaminant migration at the rated sites. Contaminants that may have been released at the sites have the potential to be transported by groundwater and surface water. The water table, which averages between 15 and 20 feet below the ground surface, has the highest risk of contamination. The fractured nature of the bedrock can provide ready access to the water table for contaminants. Additionally, released contaminants that

Table IV.1 Hazardous Materials/Hazardous Wastes Disposal Summary: Ft. Indiantown Gap Air National Guard Station, Annville, Pennsylvania.

Shop Name and Location	Possible Hazardous Wastes	Estimated Quantities (Gallons/Year)	Method of Disposal 1971 → 1975 → 1980 → 1985 → 1990
201st RHCEF Aerospace Ground Equipment (AGE) Building No. 1047	Engine Oil	100	NIE → GRND/DPDO → DPDO → CONTR
	Hydraulic Oil	10	NIE → GRND/DPDO → DPDO → CONTR
	Paint*	50	NIE → TRASH
	Paint Thinner	5	NIE → GRND → DPDO → CONTR
	Battery Acid	20	NIE → NEUT/SAN → TIS
	Trichloroethane	4	NIE → GRND → DPDO → CONTR
	Insulating Oil	30	NIE → IUNW → CONTR
271st CCS Aerospace Ground Equipment (AGE) Building No. 2073	Engine Oil	50	NIE → GRND → DPDO → CONTR
	Paint Thinner	2	NIE → GRND → DPDO → CONTR
	Paint*	5	NIE → TRASH
	PD-680 Solvent	5	NIE → GRND → SAN/OWS → NLU
	Battery Acid	7	NIE → DPDO → NEUT/SAN → DRMO
	Trichloroethane	10	NIE → GRND → DPDO → CONTR
	Diesel Oil	5	NIE → GRND → DPDO → CONTR

Table IV.1 Hazardous Materials/Hazardous Wastes Disposal Summary: Ft. Indiantown Gap Air National Guard Station, Annville, Pennsylvania (continued).

Shop Name and Location	Possible Hazardous Wastes	Estimated Quantities (Gallons/Year)	Method of Disposal 1971 — 1975 — 1980 — 1985 — 1990
112th TFG/DOMAR Vehicle Maintenance Building No. 26-139	Engine Oil	150	|___NIE___|_BUO_|__CONTR___|
	Battery Acid	5	|___NIE___|_NEUT GRND|____ND____|
	Lubricating Oil	5	|___NIE___|_BUO_|__CONTR___|
	Transmission Oil	5	|___NIE___|_BUO_|__CONTR___|
	Brake Fluid	4	|___NIE___|_BUO_|__CONTR___|
	Diesel Fuel	1	|___NIE___|___RAGS/TRASH___|
	Bearing Grease	1 Lbs	|___NIE___|___RAGS/TRASH___|
	Safety Kleen	120	|___NIE___|_____CONTR_____|
211th EIS Vehicle Maintenance Building No. 2073	Engine Oil	85	|__NIE__|_GRND/DPDO__|___DPDO___|__CONTR__|
	Battery Acid	30	|__NIE__|___NEUT/SAN___|___TIS___|
	Ethylene Glycol	25	|__NIE__|___STORM___|__CONTR__|
	Hydraulic Oil	1	|__NIE__|_GRND/DPDO__|___DPDO___|__CONTR__|
	Paint Thinner	2	|__NIE__|_GRND/DPDO__|___DPDO___|__CONTR__|
	Paint*	5	|__NIE__|___TRASH___|
	Bearing Grease	4	|__NIE__|___RAGS/TRASH___|CONTR|
	PD-680 Solvent	30	|__NIE__|_GRND/DPDO__|___DPDO___|___NLU___|
	Trichloroethane	55	|__NIE__|_GRND/DPDO__|___DPDO___|___NLU___|
	Safety Kleen	390	|__NIE__|___NIU___|__CONTR__|

Table IV.1 Hazardous Materials/Hazardous Wastes Disposal Summary: Ft. Indiantown Gap Air National Guard Station, Annville, Pennsylvania (continued).

Shop Name and Location	Possible Hazardous Wastes	Estimated Quantities (Gallons/Year)	Method of Disposal 1971 – 1975 – 1980 – 1985 – 1990
201st RHCEF Vehicle Maintenance Building No. 1048	Engine Oil	2000	DPDO; CONTR
	PD-680	55	EVAP/SAN/OWS; NLU
	Battery Acid	75	NEUT/SAN; TIS
	Ethylene Glycol	165	SAN/OWS; DRMO
	Lubricating Oil	5	DPDO; CONTR
	Hydraulic Oil	10	DPDO; CONTR
	Transmission Oil	110	DPDO; CONTR
	Paint Thinner	5	NIU; EVAP
	Paint*	1	TRASH; NLU
	Brake Fluid	2	EVAP
	Diesel Fuel	55	BTH
	Bearing Grease	15	RAGS/TRASH/SAN/OWS; CONTR
	Leaded MOGAS	55	BTH; NLU
	Unleaded MOGAS	55	BTH
	Safety Kleen	390	NIU; CONTR

Table IV.1 Hazardous Materials/Hazardous Wastes Disposal Summary: Ft. Indiantown Gap Air National Guard Station, Annville, Pennsylvania (continued).

Shop Name and Location	Possible Hazardous Wastes	Estimated Quantities (Gallons/Year)	Method of Disposal 1971	1975	1980	1985	1990
271st CCS Vehicle Maintenance Building NO. 2073	Engine Oil	500	NIE	UNK	DPDO/FTA	CONTR	
	PD-680 Solvent	50	NIE	UNK	DPDO	DRMO | NLU	
	Battery Acid	50	NIE	UNK	NEUT/SAN	DRMO	
	Ethylene Glycol	100	NIE	UNK	SAN/OWS	DRMO	
	Hydraulic Oil	10	NIE	UNK	DPDO	CONTR	
	Paint Thinner	25	NIE	UNK	DPDO/EVAP	DRMO	
	Paint*	2	NIE	UNK	TRASH		
	Brake Fluid	20	NIE	UNK	DPDO	CONTR/DRMO	
	Diesel Fluid	150	NIE	UNK	GRND/DPDO	CONTR/DRMO	
	Bearing Grease	20	NIE	UNK	RAGS/TRASH		

Table IV.1 Hazardous Materials/Hazardous Wastes Disposal Summary: Ft. Indiantown Gap Air National Guard Station, Annville, Pennsylvania (continued).

KEY:

BTH	- Material burned in tent heaters.
BUO	- Disposed of by burning to detonate unexploded ordnance at the joint use bombing range.
CONTR	- Disposed of through a contractor.
DPDO	- Disposed of through the Defense Property Disposal Office (DPDO).
DRMO	- Disposed of through the Defense Reutilization & Marketing Office. (Prior to 1986, this office was known as DPDO.)
EVAP	- Material disposed of by evaporation.
FTA	- Disposed of in a fire training area at the 193rd Special Operations Group, Pennsylvania ANG, Harrisburg International Airport, Harrisburg, Pennsylvania.
GRND	- Material was disposed on ground.
IUNW	- Material in use during this period but no waste generation.
OWS	- Material disposed of through the oil/water separator.
ND	- No disposal has occurred during this period.
NEUT	- Material neutralized with a chemical agent.
NIE	- Shop not in existence during this time.
NIU	- Material was not in use at this time.
NLU	- Material no longer used.
RAGS	- Material wiped onto rags.
SAN	- Material disposed of through the sanitary sewer.
STORM	- Material disposed of through the storm sewer.
TIS	- Battery and acid traded-in to original seller.
TRASH	- Disposed of in trash that goes to city landfill.
UNK	- Disposal method is unknown.
*	- Residue in containers.

are exposed on the ground surface have the potential to be transported by surface water migration into Qureg Run and ultimately Swatara Creek.

Locations for the three rated sites are provided on Figures IV.1A and IV.1B. The following items are descriptions of the potential sites identified at the Station:

Site No. 1 - Compound Access Road/Parking Lot (HAS-69)

Site No. 1 is located inside of the large, fenced compound for the 271st CCS Vehicle Maintenance and AGE Shops and the 211th EIS Vehicle Maintenance Shop. The entire compound is in Area 2.

The site consists of the current access road that begins at the north fence gate as a paved surface and proceeds south-southeast into the other major portion of the site, a large (440 feet x 300 feet) vehicle parking lot. The south portion of the access route and the parking lot are covered with crushed limestone.

From 1973 to 1977, waste oil admixed with paint thinner, trichloroethane, PD-680 solvent, and diesel fuel from the 271st CCS Vehicle Maintenance and AGE Shops was sprayed on the entire access road and on areas between rows of parked vehicles in the large parking lot. The oil was applied to the current crushed stone that covers the area to settle dust. The spraying rig consisted of trailer mounted drums with an attached spray bar. A forklift was used to pull the trailer.

Spraying was done two or three times each summer, and 110 gallons of waste were used for each spraying. Over a four-year period, as many as 1320 gallons of waste may have been sprayed on the access road and parking lot.

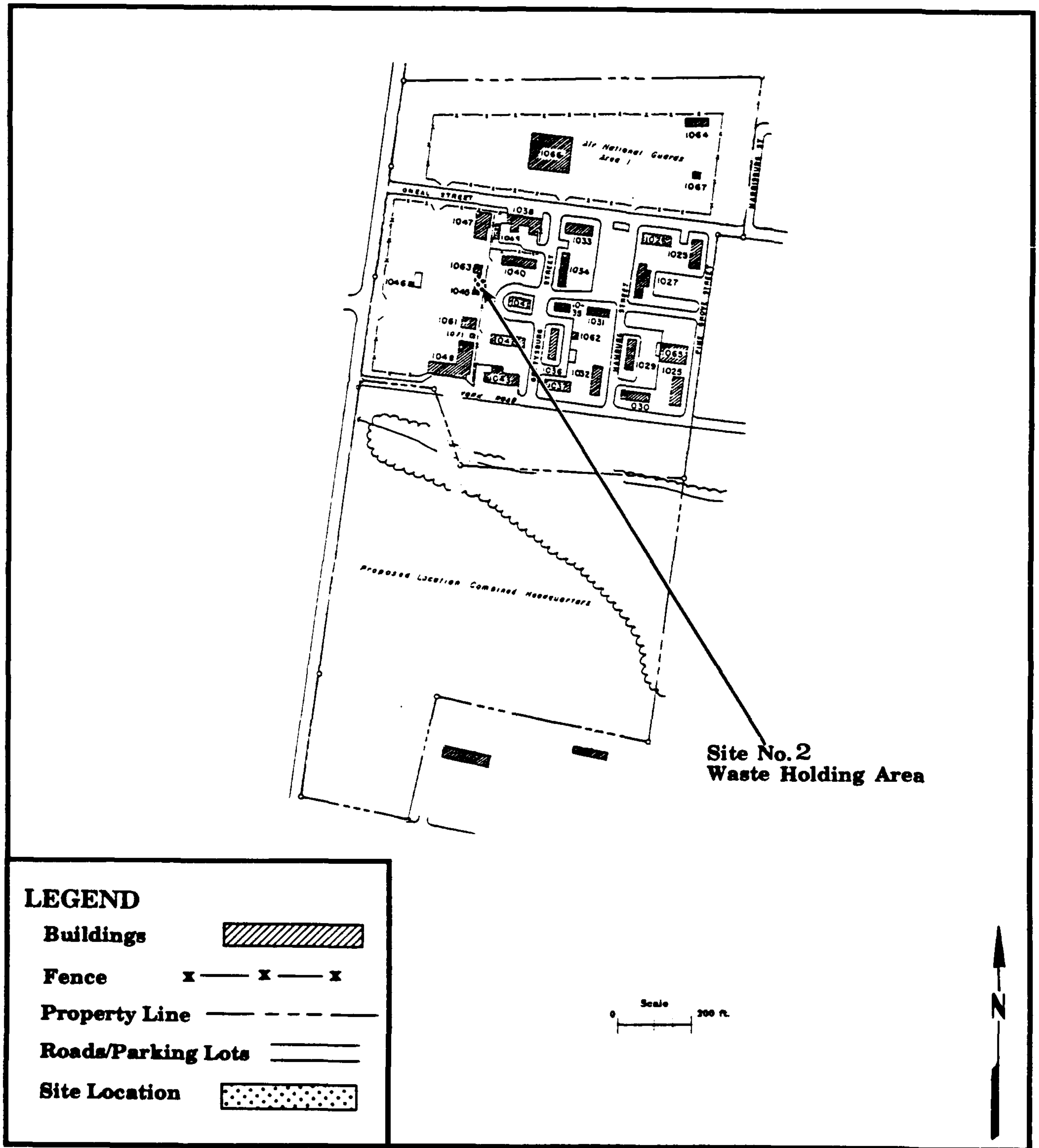
There is now no visible evidence of the applied oil. No stressed vegetation is present in the area.

In addition to the spraying, a small waste engine oil spill from a parked vehicle occurred in 1985. Approximately 40 gallons of this oil was spilled in the east central portion of the parking lot.

Given the possibility of soil and groundwater contamination from the wastes disposed of at this site, a HAS was calculated. A moderate quantity release was entered into the calculations.

Site No. 2 - Waste Holding Area (HAS-68)

The current waste holding area for the 201st RHCEF Vehicle Maintenance and AGE Shop measures approximately 20 feet north-south and 6 feet east-west. It is located in Area 1 along the perimeter fence near the southeast corner of

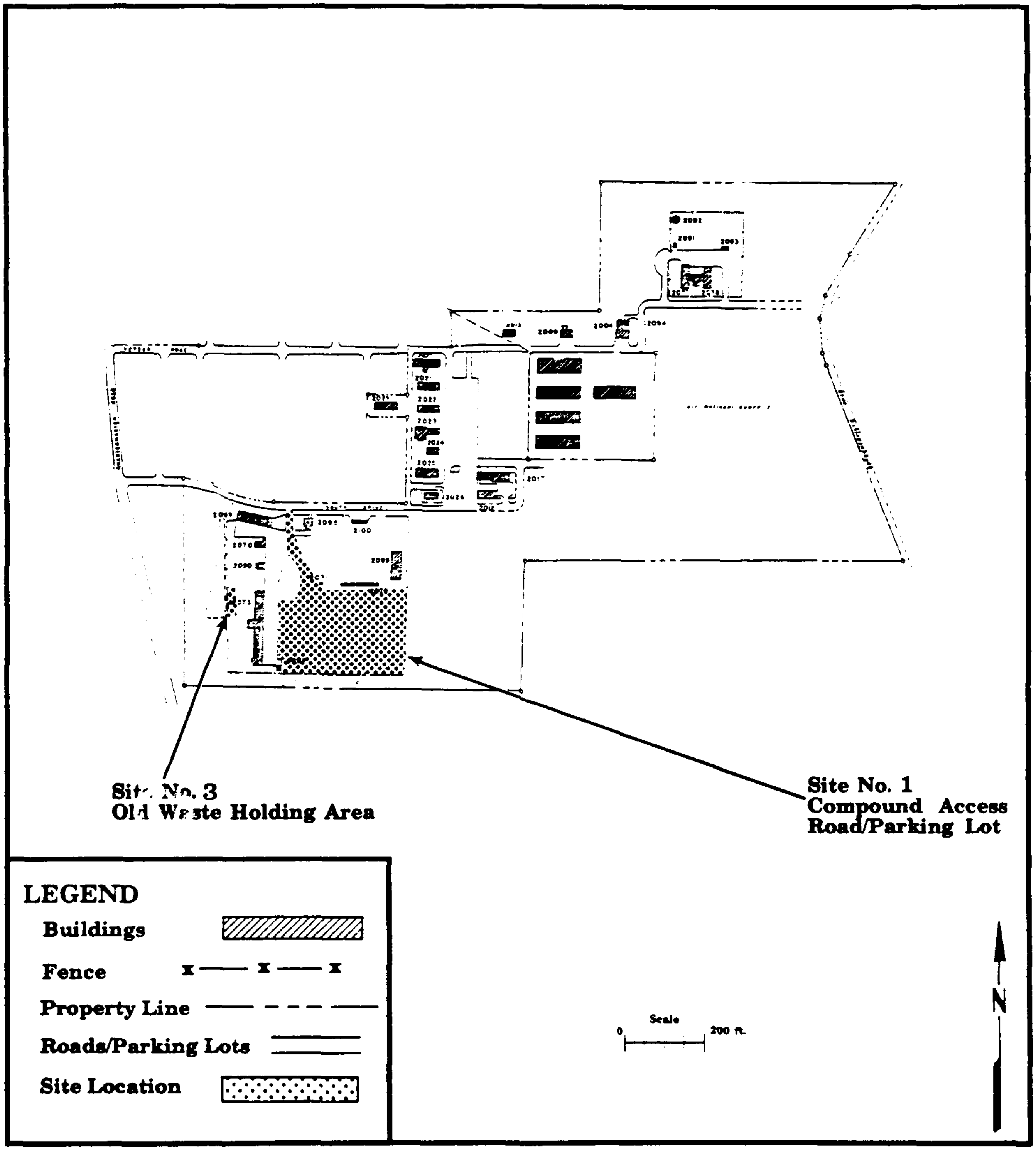


SOURCE: Worcester ANG Station, Worcester, Massachusetts, ANG Development Plan, 1989.

Figure IV.1A

Potential Sites at the Fort

Indiantown Gap Air National Guard Station -- Area 1



SOURCE: Worcester ANG Station, Worcester, Massachusetts, ANG Development Plan, 1989.

Figure IV.1B

Potential Sites at the Fort

Indiantown Gap Air National Guard Station -- Area 2

Building 1063 (Figure IV.1A). Since 1980, this area has been used to temporarily store liquid waste for pickup and disposal.

In Site No. 2, waste oil, transmission fluid, brake fluid, unleaded MOGAS, diesel fuel, leaded and unleaded MOGAS, paint thinner, and trichloroethane are stored in drums resting on wooden pallets. The pallets are sitting on a bed of crushed stone.

Numerous small spills have been associated with the filling of drums in this area. Twenty-five drums are filled with waste at this location each year, and it is estimated that approximately one gallon of waste is spilled during the overall filling of each drum. This would indicate that 250 gallons of waste have been spilled in this small area over a 10-year period. The immediate receptors of these spills were the pallets, the crushed stone beneath them, and the shaley soil that underlies the crushed stone. Heavy, black oil staining is visually evident on the crushed stone throughout the site.

In 1985, the waste in two of the drums tested positive for polychlorinated biphenyls (PCB) contamination. The PCB concentrations were 187 ppm in one drum and 163 ppm in the other. These drums were not leaking, but, if they were filled within the confines of the site, as many as two gallons of waste contaminated with PCBs may have been spilled. The source of the PCBs in these drums is unknown.

There is a potential for soil and groundwater contamination from the small quantity (less than 1100 gallons) of wastes spilled at this site. For this reason, a HAS was calculated.

Site No. 3 - Old Waste Holding Area (HAS-61)

The Old Waste Holding Area for the 271st Vehicle Maintenance Shop and AGE Shop measures approximately 20 feet north-south by 8 feet east-west. It is located inside of the large, fenced vehicle maintenance/AGE compound in Area 2. Within this compound, the site is located along the fence line west of the north end of Building 2073 (Figure IV.1B). From 1975 to 1986, this area was used to temporarily store liquid wastes for eventual pickup and disposal.

Drums containing waste oil and some admixed PD-680 solvent, diesel fuel, trichloroethane, and paint thinner were stored at Site No. 3. These drums rested on wooden pallets. Decayed wooden pallets are still located along the fence line in this area.

Approximately eight full drums accumulated at this location during each year. Small spills occurred as the drums were filled, and at least 0.5 gallons of liquid waste per drum may have been spilled during the filling process. Some of the drums stored in this area were open and overflowed during periods of

precipitation. Black oil stains were once visible in the shaley soil beneath the pallets, but there is no clear visual evidence of these stains now.

The exact quantities of waste oil, fuel, and organic solvents spilled at this potential site are unknown. For the purpose of calculating a HAS for this potential site, a small quantity (1100 gallons or less) is used.

C. Other Pertinent Facts

- o Trash and nonhazardous solid wastes from the Station are collected and disposed of by U.S. Army personnel stationed at Fort Indiantown Gap.

- o An old U.S. Army landfill is located immediately southwest of the REOTS area. This landill was in operation from 1942 to 1982. Trash from the Station was probably disposed of at this location from 1971 to 1982. There are currently eleven monitoring wells at the landfill.

- o Building 1071 was built atop the location of the old liquid waste holding area for the 201st RHCEF Vehicle Maintenance and AGE Shops. Field observations indicated that soil had been removed to construct the building. No oil stains or other evidence of contamination were observed at this location.

- o Small quantities (less than 150 gallons) of liquid wastes have been used as herbicides along portions of the fence surrounding the major activity centers for the 201st RHCEF (Vehicle Maintenance and AGE Shops) in Area 1 and the 211th EIS/271st CCS in Area 2.

- o Very small quantities of waste solvents such as paint thinner, trichloroethane, and PD-680 have been disposed of on the crushed stone or ground surfaces in the immediate vicinity of the 201st RHCEF AGE Shop, the 211th EIS/271st CCS Vehicle Maintenance Shop, and the 271st CCS AGE Shop.

- o In the Autumn of 1989, an abandoned drum of PD-680 solvent was discovered resting on soil and vegetation at the edge of a wooded area located approximately 150 feet west of Building 2091. The drum was nearly full at the time of its discovery. However, a small area of stressed vegetation around the drum was attributed to some leakage of solvent.

- o There are six abandoned underground storage tanks (UST) at the Station. Two abandoned 5000 gallon MOGAS and diesel fuel tanks are located immediately north of Building 1061 in Area 1. Four abandoned 5000 gallon MOGAS and diesel USTs are at the locations of former

fueling stations in Area 2. They are located immediately south of Buildings 2071 and 2072 and in the northern portion of Site No. 1.

These tanks were installed around 1960 and abandoned prior to 1971. Prior to abandonment, the fuel was pumped out, and they were filled with water. Residual fuel is floating on top of the water in two of the tanks in Area 2. There is no available evidence that any of the six fuel tanks have leaked.

o Four OWSs are in use at the Station. Two of these are located at Buildings 1046 (Fuel Station) and 1048 (201st RHCEF Vehicle Maintenance Shop) in Area 1. The other two are located at Building 2073 (271st CCS/211th EIS Vehicle Maintenance Shops) and at Building 2070 (Fuel Station/Vehicle Wash Rack) in Area 2.

  These OWSs are connected to the sanitary sewer system. They are checked every six months and cleaned as needed.

o On October 2, 1981, a leaking transformer was discovered south of Building 2078 in Area 2. The dielectric fluid in this transformer was tested for PCBs. A PCB concentration of <1.0 ppm indicated that it was not a PCB transformer. It was removed from service and replaced by another non-PCB transformer.

  The U.S. Army at Fort Indiantown Gap owns the transformers on the Station lease area and is responsible for maintaining them. During the 1980s, the U.S. Army conducted a comprehensive testing program to identify PCB transformers on post property, including the Station. PCB transformers identified through this program were replaced with non-PCB transformers by October 1986. Currently no PCB transformers exist on the Station lease areas.

  There are no capacitors on the Station lease areas; therefore, no PCB capacitors exist on the Station.

o The Station is not required to have a National Pollutant Discharge Elimination System Permit.

o The Station has a Spill Prevention, Control, and Countermeasures Plan and a Spill Prevention and Response Plan.

V. CONCLUSIONS

Information obtained through interviews with ten past and present Station personnel, reviews of records, and field observations was used to identify possible spill or disposal sites on the Station property. Three potentially contaminated sites were identified.

The following sites exhibit the potential for contaminant migration through surface water, soil, and/or shallow groundwater:

- o Site No. 1 - Compound Access Road/Parking Lot (HAS-69)
- o Site No. 2 - Waste Holding Area (HAS-68)
- o Site No. 3 - Old Waste Holding Area (HAS-61)

VI. RECOMMENDATIONS

The PA identified three potentially contaminated sites. As a result, additional work under the IRP is recommended for these sites to confirm the presence or absence of contamination.

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GLOSSARY OF TERMS

ALLOCHTHONOUS - Said of rocks or materials formed elsewhere than in their present place; of foreign origin.

ALLUVIAL - Pertaining to or composed of alluvium or deposited by a stream or running water.

ALLUVIUM - A general term for detrital deposits made by streams on river beds, flood plains, and alluvial fan. The term applies to stream deposits of recent time.

ANNUAL PRECIPITATION - The total amount of rainfall and snowfall for the year.

ANTICLINE - A fold, generally convex upward, whose core contains the stratigraphically older rocks.

AQUICLUDE - A body of rock that will absorb water slowly but will not transmit it fast enough to supply a well or spring.

AQUIFER - A body of rock that is sufficiently permeable to conduct groundwater and yield economically significant quantities of water to wells and springs.

ARGILLACEOUS - Like or containing clay.

ARTESIAN AQUIFER - A water-bearing bed that contains water under hydrostatic pressure.

BASIN - (a) A depressed area with no surface outlet; (b) A drainage basin or river basin; (c) A low area in the Earth's crust, of tectonic origin, in which sediments have accumulated.

BAY - A wide, curving open indentation, recess, or inlet of a sea or lake into the land or between two capes or headlands, larger than a cove, and usually smaller than, but of the same general character as a gulf.

BED [stratig] - The smallest formal unit in the hierarchy of lithostratigraphic units. In a stratified sequence of rocks, it is distinguishable from layers above and below. A bed commonly ranges in thickness from a centimeter to a few meters.

BEDDING [stratig] - The arrangement of sedimentary rock in beds or layers of varying thickness and character.

BEDROCK - A general term for the rock, usually solid, that underlies soil or other unconsolidated, superficial material.

BOULDER - A detached rock mass larger than a cobble, having a diameter greater than 256 mm, being somewhat rounded or otherwise distinctly shaped by abrasion in the course of transport.

CALCAREOUS - Containing calcium carbonate.

CARBONATE - (a) A mineral compound characterized by a fundamental anionic structure of CO_3^{-2}. (b) A sediment formed of the carbonates of calcium, magnesium and/or iron, e.g. limestone and dolomite.

CLASTIC - Pertaining to a rock or sediment composed principally of fragments derived from pre-existing rocks or minerals and transported some distance from their places of origin.

CLAY [soil] - A rock or mineral particle in the soil having a diameter less than 0.002 mm (2 microns).

CLAY [geol] - A rock or mineral fragment or a detrital particle of any composition smaller than a fine silt grain, having a diameter less than 1/256 mm (4 microns).

COARSE-TEXTURED (light textured) SOIL - Sand or loamy sand.

CONE OF DEPRESSION - The depression of heads around a pumping well caused by the withdrawal of water.

CONFINED AQUIFER - An aquifer bounded above and below by impermeable beds, or by beds of distinctly lower permeability than that of the aquifer itself.

CONGLOMERATE - A coarse-grained sedimentary rock, composed of rounded pebbles, cobbles, and boulders, set in a fine-grained matrix of sand or silt, and commonly cemented by calcium carbonate, iron oxide, silica, or hardened clay.

CONSOLIDATION - Any process whereby loosely aggregated, soft, or liquid earth materials become firm and coherent rock; specif. the solidification of a magma to form an igneous rock, or the lithification of loose sediments to form a sedimentary rock.

CONTAMINANT - As defined by Section 101(f)(33) of Superfund Amendments and Reauthorization Act of 1986 (SARA) shall include, but is not limited to any element, substance compound, or mixture, including disease-causing agents, which after release into the environment and upon exposure, ingestion, inhalation, or assimilation into any organism, either directly from the

environment or indirectly by ingestion through food chains, will or may reasonably be anticipated to cause death, disease, behavioral abnormalities, cancer, genetic mutation, physiological malfunctions (including malfunctions in reproduction), or physical deformation in such organisms of their offspring; except that the term "contaminant" shall not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically listed or designated as a hazardous substance under:

(a) any substance designated pursuant to Section 311(b)(2)(A) of the Federal Water Pollution Control Act,

(b) any element, compound, mixture, solution, or substance designated pursuant to Section 102 of this Act,

(c) any hazardous waste having the characteristics identified under or listed pursuant to Section 3001 of the Solid Waste Disposal Act (but not including any waste the regulation of which under the Solid Waste Disposal Act has been suspended by Act of Congress),

(d) any toxic pollutant listed under Section 307(a) of the Federal Water Pollution Control Act,

(e) any hazardous air pollutant listed under Section 112 of the Clean Air Act, and

(f) any imminently hazardous chemical substance or mixture with respect to which the administrator has taken action pursuant to Section 7 of the Toxic Substance Control Act;

and shall not include natural gas, liquefied natural gas, or synthetic gas of pipeline quality (or mixtures of natural gas and such synthetic gas).

CREEK - A term generally applied to any natural stream of water, normally larger than a brook but smaller than a river.

CRITICAL HABITAT - The specific areas within the geographical area occupied by the species on which are found those physical or biological features (I) essential to the conservation of the species and (II) which may require special management consideration or protection.

CUESTA - An asymmetrical ridge, with a long, gentle slope on one side conforming with the dip of the underlying strata, and a steep or clifflike face on the other side formed by the outcrop of the resistant beds.

DEPOSITS - Earth material of any type, either consolidated or unconsolidated, that has accumulated by some natural process or agent.

DIABASE - An intrusive rock whose main components are labradorite and pyroxene and which is characterized by ophitic texture.

DIORITE - A group of igneous rocks composed of dark-colored amphibole (esp. hornblende) oligoclase, andesine, pyroxene, and small amounts of quartz; the intrusive equivalent of andesite.

DIP - The angle that a stratum or any planar feature makes with the horizontal, measured perpendicular to strike and in the vertical plane.

DOLOMITE - A sedimentary rock consisting of calcium magnesium carbonate, $CaMg(CO_3)_2$. Occurs in beds formed by the alteration of limestone.

DRAINAGE CLASS (natural) - Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained - Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained - Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well-drained - Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well-drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained - Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically for long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained - Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained - Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough periods during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained - Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients, as for example in "hillpeats" and "climatic moors."

DRAINAGEWAY - A channel or course along which water moves in draining an area.

ENDANGERED SPECIES - Any species which is in danger of extinction throughout all or a significant portion of its range, other than a species of the Class Insecta determined by the secretary to constitute a pest whose protection would present an overwhelming and overriding risk to man.

EROSION - The general process or the group of processes whereby the materials of the Earth's crust are loosened, dissolved, or worn away, and simultaneously moved from one place to another by natural agencies, but usually exclude mass wasting.

FELDSPAR - Any of several crystalline minerals made up of aluminum silicates with sodium, potassium, or calcium, usually glassy and moderately hard, found in igneous rocks.

FELDSPATHIC - Like or as feldspar.

FERRUGINOUS - Pertaining to or containing iron.

FINE-GRAINED - Said of a soil in which silt and/or clay predominate.

FINE-TEXTURED (heavy textured) SOIL - Sandy clay, silty clay, and clay.

FLOOD PLAIN - The surface or strip of relatively smooth land adjacent to a river channel, constructed by the present river in its existing regimen and covered with water when the river overflows its banks.

FOLD [geol struc] - A curve or bend of a planar structure such as rock strata, bedding planes, foliation or cleavage.

FORMATION - A lithologically distinctive, mappable body of rock.

FOSSILIFEROUS - Containing fossils.

FRACTURE [struc geol] - A general term for any break in a rock, whether or not it causes displacement, due to mechanical failure by stress. Fracture includes cracks, joints, and faults.

GABBRO - A group of dark-colored, basic intrusive igneous rocks composed principally of basic plagioclase and clinopyroxene, with or without olivine and othoxypyrene; approximate intrusive equivalent of basalt.

GEOLOGIC TIME - See Figure Gl.1

GLAUCONITIC SANDSTONE - Greensand, composed of a green mineral, closely related to the micas and essentially a hydrous potassium iron silicate.

GNEISS - A coarse-grained, foliated rock produced by regional metamorphism; commonly feldspar- and quartz-rich.

GRANITE - Broadly applied, any crystalline, quartz-bearing plutonic rock; also commonly contains feldspar, mica, hornblende, or pyroxene.

GRANODIORITE - A group of coarse-grained plutonic rocks intermediate in composition between quartz diorite and quartz monzonite, containing quartz, plagioclase, and potassium feldspar with biotite, horneblende, or more rarely, pyroxene, as the mafic contents.

GRAVEL - An unconsolidated, natural accumulation of rounded rock fragments resulting from erosion, consisting predominantly of particles larger than sand, such as boulders, cobbles, pebbles, granules or any combination of these fragments.

GRAYWACKE - A non-porous, dark-colored sandstone containing angular grains and fragments of other rocks; a fine-grained conglomerate resembling sandstone.

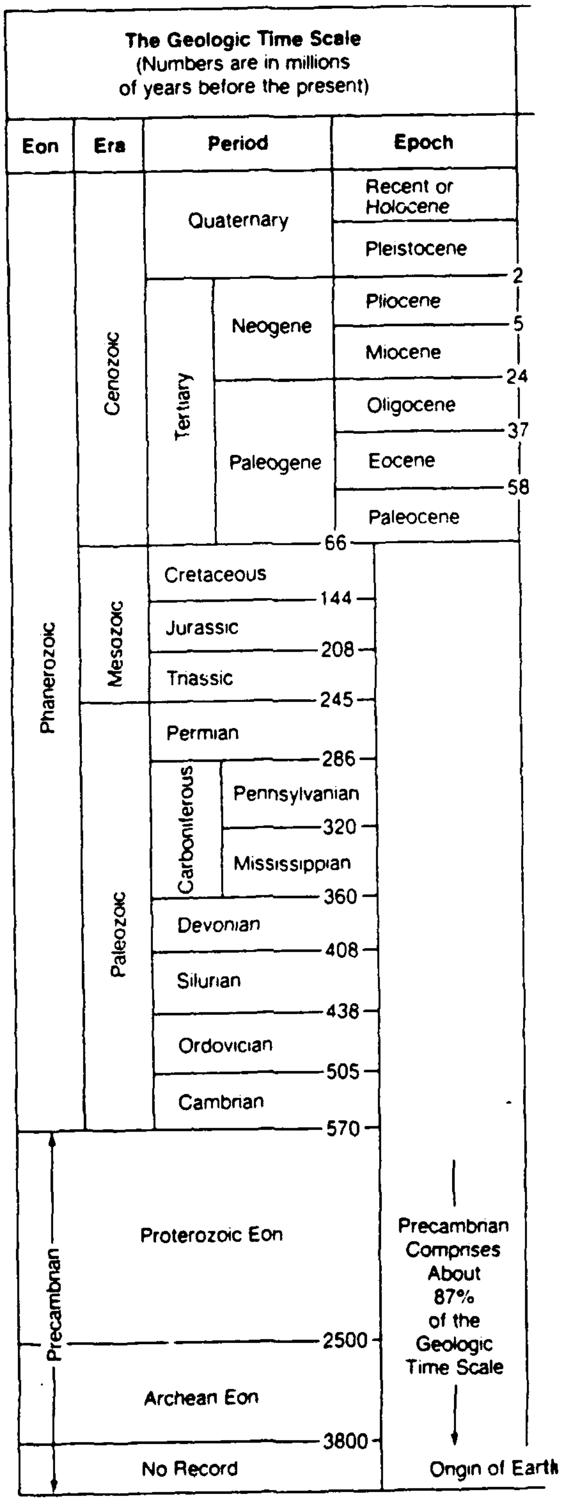

Figure Gl.1

The Geologic Time Scale

GROUNDWATER - Refers to the subsurface water that occurs beneath the water table in soils and geologic formations that are fully saturated.

HARM - Hazard Assessment Rating Methodology - A system adopted and used by the United States Air Force to develop and maintain a priority listing of potentially contaminated sites on installations and facilities for remedial action based on potential hazard to public health, welfare, and environmental impacts. (Reference: DEQPPM 81-5, December 11, 1981.)

HAS - Hazard Assessment Score - The score developed by using the Hazard Assessment Rating Methodology (HARM).

HAZARDOUS MATERIAL - Any substance or mixture of substances having properties capable of producing adverse effects on the health and safety of the human being. Specific regulatory definitions also found in OSHA and DOT rules.

HAZARDOUS WASTE - A solid or liquid waste that, because of its quantity, concentration, or physical, chemical, or infectious characteristics may:

a. cause, or significantly contribute to, an increase in mortality or an increase in serious or incapacitating reversible illness, or

b. pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, disposed of, or otherwise managed.

HERBICIDE - A weed killer.

HIGHLAND - A general term for a relatively large area of elevated or mountainous land standing prominently above adjacent low areas; and mountainous region.

HILL - A natural elevation of the land surface, rising rather prominently above the surrounding land, usually of limited extent and having a well-defined outline (rounded) and generally considered to be less than 1000 feet from base to summit.

IGNEOUS ROCKS - Rock or mineral that has solidified from molten or partially molten material, i.e. from magma.

INTERBEDDED - Beds lying between or alternating with others of different character; especially rock material laid down in sequence between other beds.

KARST - A type of topography that is formed over limestone, dolomite,or gypsum by dissolution, and that is characterized by sinkholes, caves and underground drainage.

KLIPPE - An isolated mass of rock that is an erosional remnant or outlier of a nappe.

LIMESTONE - A sedimentary rock consisting of the mineral calcite (calcium carbonate, $CaCo_3$) with or without magnesium carbonate.

LIMONITE - A common secondary material, formed by weathering (oxidation) of iron-bearing materials.

LITHOLOGY - (a) The description of rocks. (b) The physical character of a rock.

LOAM - A rich, permeable soil composed of a friable mixture of relatively equal proportions of sand, silt, and clay particles, and usually containing organic matter.

LOWLAND - A general term for low-lying land or an extensive region of low land, especially near the coast and including the extended plains or country lying not far above tide level.

MARBLE - A metamorphic rock consisting predominantly of fine- to coarse-grained recrystallized calcite and/or dolomite, usually with granoblastic, saccharoidal texture.

MARSH - A water-saturated, poorly drained area, intermittently or permanently water-covered, having aquatic and grasslike vegetation, essentially without the formation of peat.

MEAN LAKE EVAPORATION - The total evaporation amount for a particular area; amount based on precipitation and climate (humidity).

METAMORPHIC ROCK - Any rock derived from pre-existing rocks by mineralogical, chemical, and/or structural changes, essentially in solid state, in response to marked changes in temperature, pressure, shearing stress, and chemical environment, generally at depth in the Earth's crust.

MIGRATION [Contaminant] - The movement of contaminants through pathways (groundwater, surface water, soil, and air).

MINERAL - A naturally occurring inorganic element or compound having an orderly internal structure and characteristic chemical composition, crystal form and physical properties.

MOTTLED [soil] - A soil that is irregularly marked with spots or patches of different colors, usually indicating poor aeration or seasonal wetness.

NAPPE - A sheetlike, allochthonous, folded rock unit in which the axial plane is horizontal or subhorizontal. The mechanism may be thrust faulting, recumbent folding, or gravity sliding.

NET PRECIPITATION - Precipitation minus evaporation.

OUTCROP - That part of a geologic formation or structure that appears at the surface of the Earth; also, bedrock that is covered only by surficial deposits such as alluvium.

OVERTURNED - Said of a fold or the limb of a fold, that has tilted beyond the perpendicular sequence of strata and thus appears reversed.

PD-680 - A cleaning solvent composed predominately of mineral spirits; Stoddard solvent.

PEAT - An unconsolidated deposit of semicarbonized plant remains in a water-saturated environment and of persistently high moisture content (at least 75%).

PERMEABILITY - The capacity of a porous rock, sediment, or soil for transmitting a fluid without impairment by the structure of the medium; it is a measure of the relative ease of fluid flow under unequal pressure.

POND - A natural body of standing fresh water occupying a small surface depression, usually smaller than a lake and larger then a pool.

POROSITY - The ratio of the aggregate volume of interstices in a rock or soil to its total volume.

POTENTIOMETRIC SURFACE - An imaginary surface representing the total head of groundwater and defined by the level to which water will rise in a well. The water table is a particular potentiometric surface.

QUARTZ - A crystalline silica, an important rock forming mineral: SiO_2. Occurs either in transparent hexagonal crystals (colorless or colored by impurities) or in crystalline. Forms the major proportion of most sands and has a widespread distribution in igneous, metamorphic and sedimentary rocks.

QUARTZITE [meta] - A granoblastic metamorphic rock consisting mainly of quartz and formed by recrystallization of sandstone or chert by either regional or thermal metamorphism.

RECUMBENT FOLD - An overturned fold in which the axial surface is more or less horizontal.

RIVER - A general term for a natural freshwater surface stream of considerable volume and a permanent or seasonal flow, moving in a definite channel toward a sea, lake, or another river.

SALINE [adj] - Salty; containing dissolved sodium chloride.

SAND - A rock or mineral particle in the soil, having a diameter in the range 0.52 - 2 mm.

SANDSTONE - A medium-grained fragmented sedimentary rock composed of abundant round or angular sand fragments set in a fine-grained matrix (silt or clay) and more or less firmly united by a cementing material (commonly silica, iron oxide, or calcium carbonate).

SANDY LOAM - A soil containing 43 - 85% sand, 0 - 50% silt, and 0 - 20% clay, or containing at least 52% sand and no more than 20% clay and having the percentage of silt plus twice the percentage of clay exceeding 30% or containing 43 - 52% sand, less than 50% silt, and less than 7% clay.

SCHIST - A medium- or coarse-grained, strongly foliated, crystalline rock; formed by dynamic metamorphism.

SCHISTOCITY - The foliation in schist or other coarse-grained, crystalline rock due to the parallel, planar arrangement of mineral grains of the platy, prismatic, or ellipsoidal types, usually mica.

SEDIMENT - Solid fragmental material that originates from weathering of rocks and is transported or deposited by air, water, or ice, or that accumulates by other natural agents, such as chemical precipitation from solution or secretion by organisms, and that forms in layers on the Earth's surface at ordinary temperatures in a loose, unconsolidated form; (b) strictly solid material that has settled down from a state of suspension in a liquid.

SEDIMENTARY ROCK - A rock resulting from the consolidation of loose sediment that has accumulated in layers; e.g., a clastic rock (such as conglomerate or tillite) consisting of mechanically formed fragments of older rock transported from its source and deposited in water or from air or ice; or a chemical rock (such as rock salt or gypsum) formed by precipitation from solution; or an organic rock (such as certain limestones) consisting of the remains or secretions of plants and animals.

SHALE - A fine-grained detrital sedimentary rock, formed by the consolidation (especially by compression) of clay, silt, or mud.

SILT [soil] - (a) A rock or mineral particle in the soil, having a diameter in the range 0.002-0.005 mm; (b) A soil containing more than 80% silt-size particles, less than 12% clay, and less than 20% sand.

SILT LOAM - A soil containing 50 - 88% silt, 0 - 27% clay, and 0 - 50% sand.

SILTSTONE - An indurated silt having the texture and composition of shale but lacking its fine lamination or fissility; a massive mudstone in which silt predominates over clay.

SLATE - A compact, fine-grained metamorphic rock that possesses slaty cleavage and hence can be split into slabs and thin plates. Most slate was formed from shale.

SOIL PERMEABILITY - The characteristic of the soil that enables water to move downward through the profile. Permeability is measured as the distance per unit time that water moves downward through the saturated soil.

Terms describing permeability are:

Very Slow	-	less than 0.06 inches per hour (less than 4.24×10^{-5} cm/sec)
Slow	-	0.06 to 0.20 inches per hour (4.24×10^{-5} to 1.41×10^{-4} cm/sec)
Moderately Slow	-	0.20 to 0.63 inches per hour (1.41×10^{-4} to 4.45×10^{-4} cm/sec)
Moderate	-	0.63 to 2.00 inches per hour (4.45×10^{-4} to 1.41×10^{-3} cm/sec)
Moderately Rapid	-	2.00 to 6.00 inches per hour (1.41×10^{-3} to 4.24×10^{-3} cm/sec)
Rapid	-	6.00 to 20.00 inches per hour (4.24×10^{-3} to 1.41×10^{-2} cm/sec)
Very Rapid	-	more than 20.00 inches per hour (more than 1.41×10^{-2} cm/sec)

(Reference: U.S.D.A. Soil Conservation Service)

SOIL REACTION - The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests of pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as:

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

SOIL STRUCTURE - The arrangement of primary soil particles into compound particles or aggregates that are separated from adjoining aggregates. The principal forms of soil structure are -- platty (laminated), prismatic (vertical axis of aggregates longer than horizontal), columnar (prisms with rounded tops), blocky (angular or subangular), and granular. Structureless soils are either single grained (each grain by itself, as in dune sand) or massive (the particles adhering without any regular cleavage, as in many hardpans).

SOLVENT - A substance, generally a liquid, capable of dissolving other substances.

STONE - A general term for rock that is used for construction, either crushed for use as aggregate or cut into shaped blocks as dimension stone.

STRATIFIED - Formed, arranged, or laid down in layers or strata; especially said of any layered sedimentary rock or deposit.

STRATIGRAPHIC UNIT - A body of strata recognized as a unit for description, mapping, or correlation.

STRIKE - The direction taken by a structural surface, e.g., a bedding or fault plane, as it intersects the horizontal.

STRIKE - SLIP FAULT - A fault on which the movement is parallel to the fault's strike.

STRUCTURAL - Of or pertaining to rock deformation or to features that result from it.

SURFACE WATER - All water exposed at the ground surface, including streams, rivers, ponds, and lakes.

SWAMP - An area intermittently or permanently covered with water, having shrubs and trees but essentially without the accumulation of peat.

SYNCLINE - A fold of which the core contains the stratigraphically younger rocks; it is generally concave upward.

SYNCLINORIUM - A composite synclinal structure of regional extent composed of lesser folds.

TERRACE [geomorph] - Any long, narrow, relatively level or gently inclined surface, generally less broad than a plain, bounded along one edge by a steeper descending slope and along the other by a steeper ascending slope.

TERRACE [soil] - A horizontal or gently sloping ridge or embankment of earth built along the contours of a hillside for the purpose of conserving moisture, reducing erosion, or controlling runoff.

THREATENED SPECIES - Any species which is likely to become an endangered species within the foreseeable future throughout all or significant portion of its range.

TIME [geol] - See Figure Gl.1.

TOPOGRAPHY - The general conformation of a land surface, including its relief and the position of its natural and man-made features.

UNCONSOLIDATED - (a) Sediment that is loosely arranged or unstratified, or whose particles are not cemented together, occurring either at the surface or at depth. (b) Soil material that is in a loosely aggregated form.

UNDULATING [geomorph] - (a) A landform having a wavy outline or form. (b) A rippling or scalloped land surface, having a wavy outline or appearance.

VALLEY - Any low-lying land bordered by higher ground, especially an elongate, relatively large, gently sloping depression of the earth's surface, commonly situated between two mountains or between ranges of hills and mountains, and often containing a stream or river with an outlet. It is usually developed by stream or river erosion, but can be formed by faulting.

VEIN [intrus rock] - A thin, sheetlike igneous intrusion into a fissure.

WATER TABLE - The upper limit of the portion of the ground that is wholly saturated with water; the surface on which the fluid pressure in the pores of a porous medium is exactly atmospheric.

WETLANDS - Those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

WILDERNESS AREA - An area unaffected by anthropogenic activities and deemed worthy of special attention to maintain its natural condition.

Appendix A

Outside Agency Contact List

OUTSIDE AGENCY CONTACT LIST

1) City of Lebanon, Pennsylvania
Bureau of Public Works
400 South Eight Street
Lebanon, Pennsylvania 17042
James G. Cummings
(717) 273-6711

2) Commonwealth of Pennsylvania
Bureau of Forestry
Forest Advisory Services
P.O. Box 8552
Harrisburg, Pennsylvania 17105-8552
Kathy McKenna
Ed Dix
(717) 787-3444
(717) 783-0392

3) Commonwealth of Pennsylvania
Department of Environmental Resources
1 Ararat Boulevard
Harrisburg, Pennsylvania 17710
William Botts
(717) 657-4590

4) Commonwealth of Pennsylvania
Department of General Services
State Bookstore
P.O. Box 1365
Harrisburg, Pennsylvania 17105
Patricia Chapman
(717) 787-5109

5) Commonwealth of Pennsylvania
Pennsylvania Fish Commission
Division of Fisheries Management
450 Robinson Lane
Belleforte, Pennsylvania 16823-9616
Clark N. Shiffer
(814) 359-5113

OUTSIDE AGENCY CONTACT LIST (continued)

6) Commonwealth of Pennsylvania
Pennsylvania Game Commission
Bureau of Land Management
2001 Elmerton Avenue
Harrisburg, Pennsylvania 17110-9797
Denver A. McDowell, Jr.
(717) 783-8743

7) Commonwealth of Pennsylvania
Topographic and Geological Survey
Department of Environmental Resources
P.O. Box 2357
Harrisburg, Pennsylvania 17120
Mari G. Barnhart
Dona Snyder
Dawna Yannacci
(717) 787-5828

8) Dauphin Consolidated Water Supply Company
P.O. Box 4151
Harrisburg, Pennsylvania 17711
Kirby Pack
(717) 232-6207

9) Fort Indiantown Gap
Directorate of Engineering and Housing
Environmental/Energy Office
Attn: AFKA-ZQ-DE-E
Annville, Pennsylvania 17003-5011
Kenneth L. Malick
(717) 865-5444

10) Headquarters
U.S. Army Garrison
Fort Indiantown Gap
Annville, Pennsylvania 17003
Specialist Ian Murdock
(717) 865-5444 ext. 2193

11) United States Department of Agriculture (USDA)
Soil Conservation Service
Suite 4 (Side Entrance)
201 Cumberland Street
Lebanon, Pennsylvania 17042
Charles Wertz
(717) 272-4618

Appendix B

USAF Hazard Assessment Rating Methodology

USAF HAZARD ASSESSMENT RATING METHODOLOGY

The DoD has developed a comprehensive program to identify, evaluate, and control hazardous waste disposal practices associated with past waste disposal techniques at DoD facilities. One of the actions required under this program is to:

> Develop and maintain a priority listing of contaminated installations and facilities for remedial action based on potential hazard to public health, welfare, and environmental impacts (Reference: DEQPPM 81-5, December 11, 1981).

Accordingly, the USAF has sought to establish a system to set priorities for taking further action at sites based upon information gathered during the PA phase of the IRP.

PURPOSE

The purpose of the site rating model is to assign a ranking to each site where there is suspected contamination from hazardous substances. This model will assist the ANG in setting priorities for follow-up site investigations.

This rating system is used only after it has been determined that (1) potential for contamination exists (hazardous waste present in sufficient quantity), and (2) potential for migration exists. A site may be deleted from ranking consideration on either basis.

DESCRIPTION OF THE MODEL

Like the other hazardous waste site ranking models, the USAF's site rating model uses a scoring system to rank sites for priority attention. However, in developing this model, the designers incorporated some special features to meet specific DoD needs.

The model uses data readily obtained during the Preliminary Assessment portion of the IRP. Scoring judgment and computations are easily made. In assessing the hazards at a given site, the model develops a score based on the most likely routes of contamination and worst hazards at the site. Sites are given low scores only if there are clearly no hazards. This approach meshes well with the policy for evaluating and setting restrictions on excess DoD properties.

Site scores are developed using the appropriate ranking factors presented in this appendix. The site rating form and the rating factor guidelines are provided at the end of this appendix.

As with the previous model, this model considers four aspects of the hazard posed by a specific site: (1) possible receptors of the contamination, (2) the waste and its characteristics, (3) the potential pathways for contaminant migration, and (4) any effort that was made to contain the waste resulting from a spill.

The receptors category rating is based on four rating factors: (1) the potential for human exposure to the site, (2) the potential for human ingestion of contaminants should underlying aquifers be polluted, (3) the current and anticipated use of the surrounding area, and (4) the potential for adverse effects upon important biological resources and fragile natural settings. The potential for human exposure is evaluated on the basis of the total population within 1000 feet of the site, and the distance between the site and the base boundary. The potential for human ingestion of contaminants is based on the distance between the site and the nearest well, the groundwater use of the uppermost aquifer, and population served by the groundwater supply within 3 miles of the site. The uses of the surrounding area are determined by the zoning within a 1-mile radius. Determination of whether or not critical environments exist within a 1-mile radius of the site predicts the potential for adverse effects from the site upon important biological resources and fragile natural settings. Each rating factor is numerically evaluated (0-3) and increased by a multiplier. The maximum possible score is also computed. The factor score and maximum possible scores are totaled, and the receptors subscore computed as follows: receptors subscore = (100 X factor subtotal/maximum score subtotal).

The waste characteristics category is scored in three steps. First, a point rating is assigned based on an assessment of the waste quantity and the hazard (worst case) associated with the site. The level of confidence in the information is also factored into the assessment. Next, the score is multiplied by a waste persistence factor, which acts to reduce the score if the waste is not very persistent. Finally, the score is further modified by the physical state of the waste. Liquid wastes receive the maximum score while scores for solids are reduced.

The pathways category rating is based on evidence of contaminant migration along one of three pathways: surface water migration, flooding, and groundwater migration. If evidence of contaminant migration exists, the category is given a subscore of 80 to 100 points. For indirect evidence, 80 points are assigned, and for direct evidence, 100 points are assigned. If no evidence is found, the highest score among the three possible routes is used. The three pathways are evaluated and the highest score among all four of the potential scores is used.

The scores for each of the three categories are added together and normalized to a maximum possible score of 100. Then the waste management practice category is scored. Scores for sites with no containment are not reduced. Scores for sites with limited containment can be reduced by 5 percent. If a site is contained and well-managed, its score can be reduced by 90 percent. The final site score is calculated by applying the waste management practices category factor to the sum of the score for the other three categories.

HAZARD ASSESSMENT RATING FORM

NAME OF SITE

LOCATION ______________________________

DATE OF OPERATION OR OCCURRENCE ______________________________

OWNER/OPERATOR ______________________________

COMMENTS/DESCRIPTION ______________________________

SITE RATED BY ______________________________

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1000 ft. of site		4		12
B. Distance to nearest well		10		30
C. Land use-zoning within 1-mile radius		3		9
D. Distance to installation boundary		6		18
E. Critical environments within 1-mile radius of site		10		30
F. Water quality of nearest surface water body		6		18
G. Groundwater use of uppermost aquifer		9		27
H. Population served by surface water supply within 3 miles downstream of site		6		18
I. Population served by groundwater supply within 3 miles of site		6		18

Subtotals ________ 180

Receptors subscore (100 x factor score subtotal/maximum score subtotal)

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) ________
2. Confidence level (C = confirmed, S = suspected) ________
3. Hazard rating (H = high, M = medium, L = low) ________

Factor Subscore A (from 20 to 100 based on factor score matrix)

B. Apply persistence factor
Factor subscore A x Persistence Factor = Subscore B

________ x ________ = ________

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

________ x ________ =

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists, then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore

B. Rate the migration potential for 3 potential pathways: Surface water migration, flooding, and groundwater migration. Select the highest rating, and proceed to C.

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water		8		24
Net precipitation		6		18
Surface erosion		8		24
Surface permeability		6		18
Rainfall intensity		8		24

Subtotals ________ 108

Subscore (100 x factor score subtotal/maximum score subtotal)

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
2. Flooding		1		3

Subscore (100 x factor score/3)

3. Groundwater migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to groundwater		8		24
Net precipitation		6		18
Soil permeability		8		24
Subsurface flows		8		24
Direct access to groundwater		8		24

Subtotals ________ 114

Subscore (100 x factor score subtotal/maximum score subtotal)

C. Highest pathway score

Enter the highest subscore value from A, B-1, B-2, or B-3 above

Pathways subscore

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors
Waste Characteristics
Pathways

Total ________ divided by 3 = ________

Gross Total Score

B. Apply factor for waste containment from waste management practices.

Gross Total Score x Waste Management Practices Factor = Final Score

________ x ________ = $\boxed{}$

HAZARD ASSESSMENT RATING METHODOLOGY GUIDELINES

I. RECEPTORS CATEGORY

Rating Factors	Rating Scale Levels 0	1	2	3	Multiplier
A. Population within 1,000 feet (includes on-base facilities)	0	1-25	26-100	Greater than 100	4
B. Distance to nearest water well	Greater than 3 miles	1 to 3 miles	3,001 feet to 1 mile	0 to 3,000 feet	10
C. Land use/zoning (within 1-mile radius)	Completely remote (zoning not applicable)	Agricultural	Commercial or Industrial	Residential	3
D. Distance to installation boundary	Greater than 2 miles	1 to 2 miles	1,001 feet to 1 mile	0 to 1,000 feet	6
E. Critical environments (within 1-mile radius)	Not a critical environment	Natural areas	Pristine natural areas; minor wetlands; preserved areas; presence of economically important natural resources susceptible to contamination	Major habitat of an endangered or threatened species; presence of recharge area; major wetlands	10
F. Water quality/use designation of nearest surface water body	Agricultural or industrial use	Recreation, propagation and management of fish and wildlife	Shellfish propagation and harvesting	Potable water supplies	6
G. Groundwater use of uppermost aquifer	Not used, other sources readily available	Commercial industrial, or irrigation, very limited other water sources	Drinking water, municipal water available	Drinking water, no municipal water available, commercial, industrial, or irrigation; no other water source available	9
H. Population served by surface water supplies within 3 miles downstream of site	0	1-50	51-1,000	Greater than 1,000	6
I. Population served by aquifer supplies within 3 miles of site	0	1-50	51-1,000	Greater than 1,000	6

II. WASTE CHARACTERISTICS

A-1 Hazardous Waste Quantity

S = Small quantity (5 tons or 20 drums of liquid)
M = Moderate quantity (5 to 20 tons or 21 to 85 drums of liquid)
L = Large quantity (20 tons or 85 drums of liquid)

A-2 Confidence Level of Information

C = Confirmed confidence level (minimum criteria below)

- o Verbal reports from interviewer (at least 2) or written information from the records
- o Knowledge of types and quantities of wastes generated by shops and other areas on base

S = Suspected confidence level

- o No verbal reports or conflicting verbal reports and no written information from the records
- o Logic based on a knowledge of the types and quantities of hazardous wastes generated at the base, and a history of past waste disposal practices indicate that these wastes were disposed of at a site

A-3 Hazard Rating

Rating Factors	Rating Scale Levels 0	1	2	3
Toxicity	Sax's Level 0	Sax's Level 1	Sax's Level 2	Sax's Level 3
Ignitability	Flash point greater than 200°F	Flash point at 140°F to 200°F	Flash point at 80°F to 140°F	Flash point less than 80°F
Radioactivity	At or below background levels	1 to 3 times background levels	3 to 5 times background levels	Over 5 times background levels

Use the highest individual rating based on toxicity, ignitability, and radioactivity and determine the hazard rating.

Hazard Rating	Points
High (H)	3
Medium (M)	2
Low (L)	1

II. WASTE CHARACTERISTICS--Continued

Waste Characteristics Matrix

Point Rating	Hazardous Waste Quantity	Confidence Level of Information	Hazard Rating
100	L	C	H
	L	C	H
80	H	C	H
70	L	S	H
	S	C	H
60	H	C	H
	L	S	H
	L	C	L
50	H	S	H
	S	C	H
	S	S	H
	H	S	H
40	H	C	L
	L	S	L
	S	C	L
30	H	S	L
	S	S	H
20	S	S	L

Notes:
For a site with more than one hazardous waste, the waste quantities may be added using the following rules:
Confidence Level
- o Confirmed confidence levels (C) can be added.
- o Suspected confidence levels (S) can be added.
- o Confirmed confidence levels cannot be added with suspected confidence levels.

Waste Hazard Rating
- o Wastes with the same hazard rating can be added.
- o Wastes with different hazard ratings can only be added in a downgrade mode, e.g., MCM + SCH = LCM if the total quantity is greater than 20 tons.

Example: Several wastes may be present at a site, each having an MCM designation (60 points). By adding the quantities of each waste, the designation may change to LCM (80 points). In this case, the correct point rating for the waste is 80.

B. Persistence Multiplier for Point Rating

Persistence Criteria	Multiply Point Rating From Part A by the Following
Metals, polycyclic compounds, and halogenated hydrocarbons	1.0
Substituted and other ring compounds	0.9
Straight chain hydrocarbons	0.8
Easily biodegradable compounds	0.4

C. Physical State Multiplier

Physical state	Multiply Point Total From Parts A and B by the Following
Liquid	1.0
Sludge	0.75
Solid	0.50

III. PATHWAYS CATEGORY

A. Evidence of Contamination

Direct evidence is obtained from laboratory analyses of hazardous contaminants present above natural background levels in surface water, groundwater, or air. Evidence should confirm that the source of contamination is the site being evaluated.

Indirect evidence might be from visual observation (i.e., leachate), vegetation stress, sludge deposits, presence of taste and odors in drinking water, or reported discharges that cannot be directly confirmed as resulting from the site, but the site is greatly suspected of being a source of contamination.

B-1 Potential for Surface Water Contamination

Rating Factors	0	1	2	3	Multiplier
Distance to nearest surface water (includes drainage ditches and storm sewers)	Greater than 1 mile	2,001 feet to a mile	501 feet to 2,000 feet	0 to 500 feet	8
Net precipitation	Less than -10 inches	-10 to +5 inches	+5 to +20 inches	Greater than +20 inches	6
Surface erosion	None	Slight	Moderate	Severe	8
Surface permeability	0% to 15% clay ($>10^{-2}$ cm/sec)	15% to 30% clay (10^{-2} to 10^{-4} cm/sec)	30% to 50% clay (10^{-4} to 10^{-6} cm/sec)	Greater than 50% clay ($<10^{-6}$ cm/sec)	6
Rainfall intensity based on 1-year, 24 hour rainfall (thunderstorms)	<1.0 inch 0-5 0	1.0 to 2.0 inches 6-35 30	2.1 to 3.0 inches 36-49 60	>3.0 inches >50 100	8

B-2 Potential for Flooding

Rating Factors	0	1	2	3	Multiplier
Floodplain	Beyond 100-year floodplain	In 100-year floodplain	In 10-year floodplain	Floods annually	1

B-3 Potential for Groundwater Contamination

Rating Factors	0	1	2	3	Multiplier
Depth to groundwater	Greater than 500 feet	50 to 500 feet	11 to 50 feet	0 to 10 feet	8
Net precipitation	Less than -10 inches	-10 to +5 inches	+5 to +20 inches	Greater than +20 inches	6
Soil permeability	Greater than 50% clay ($<10^{-6}$ cm/sec)	30% to 50% clay (10^{-4} to 10^{-6} cm/sec)	15% to 30% clay 10^{-2} to 10^{-4} cm/sec	0% to 15% clay ($>10^{-2}$ cm/sec)	8
Subsurface flows	Bottom of site greater than 5 feet above high groundwater level	Bottom of site occasionally submerged	Bottom of site frequently submerged	Bottom of site located below mean groundwater level	8
Direct access to groundwater (through faults, fractures, faulty well casings, subsidence, fissures, etc.)	No evidence of risk	Low risk	Moderate risk	High risk	8

IV. WASTE MANAGEMENT PRACTICES CATEGORY

A. This category adjusts the total risk as determined from the receptors, pathways, and waste characteristics categories for waste management practices and engineering controls designed to reduce this risk. The total risk is determined by first averaging the receptors, pathways, and waste characteristics subscores.

B. Waste Management Practices Factor

The following multipliers are then applied to the total risk points (from A):

Waste Management Practice	Multiplier
No containment	1.0
Limited containment	0.95
Fully contained and in full compliance	0.10

Guidelines for fully contained:

Landfills:

- o Clay cap or other impermeable cover
- o Leachate collection system
- o Liners in good condition
- o Adequate monitoring wells

Surface Impoundments:

- o Liners in good condition
- o Sound dikes and adequate freeboard
- o Adequate monitoring wells

Spills:

- o Quick spill cleanup action taken
- o Contaminated soil removed
- o Soil and/or water samples confirm total cleanup of the spill

Fire Protection Training Areas:

- o Concrete surface and berms
- o Oil/water separator for pretreatment of runoff
- o Effluent from oil/water separator to treatment plant

General Note: If data are not available or known to be complete the factor ratings under Items I-A through I, III-B-1, or III-B-3, then leave blank for calculation of factor score and maximum possible score.

Appendix C

Site Hazard Assessment Rating Forms and Factor Rating Criteria

HAZARD ASSESSMENT RATING FORM

NAME OF SITE Compound Access Road/Parking Lot (Site No. 1)

LOCATION Area 2

DATE OF OPERATION OR OCCURRENCE 1973-1977

OWNER/OPERATOR Fort Indiantown Gap Air National Guard Station

COMMENTS/DESCRIPTION

SITE RATED BY Science & Technology, Inc.

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1000 ft. of site	3	4	12	12
B. Distance to nearest well	3	10	30	30
C. Land use-zoning within 1-mile radius	3	3	9	9
D. Distance to installation boundary	3	6	18	18
E. Critical environments within 1-mile radius of site	2	10	20	30
F. Water quality of nearest surface water body	1	6	6	18
G. Groundwater use of uppermost aquifier	2	9	18	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by groundwater supply within 3 miles of site	2	6	12	18
		Subtotals	125	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 69

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) M
2. Confidence level (C = confirmed, S = suspected) C
3. Hazard rating (H = high, M = medium, L = low) H

Factor Subscore A (from 20 to 100 based on factor score matrix) 80

B. Apply persistence factor
Factor subscore A x Persistence Factor = Subscore B

80 x 0.9 = 72

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

72 x 1.0 = 72

III. PATHWAYS Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists, then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: Surface water migration, flooding, and groundwater migration. Select the highest rating, and proceed to C.

1. Surface water migration

Distance to nearest surface water	3	8	24	24
Net precipitation	2	6	12	18
Surface erosion	1	8	8	24
Surface permeability	2	6	12	18
Rainfall intensity	2	8	16	24
		Subtotals	72	108

Subscore (100 x factor score subtotal/maximum score subtotal) 67

2. Flooding	0	1	0	3

Subscore (100 x factor score/3) 0

3. Groundwater migration

Depth to groundwater	2	8	16	24
Net precipitation	2	6	12	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to groundwater	3	8	24	24
		Subtotals	68	114

Subscore (100 x factor score subtotal/maximum score subtotal) 60

C. Highest pathway score

Enter the highest subscore value from A, B-1, B-2, or B-3 above

Pathways subscore 67

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	69
Waste Characteristics	72
Pathways	67

Total 208 divided by 3 = 69

Gross Total Score

B. Apply factor for waste containment from waste management practices.

Gross Total Score x Waste Management Practices Factor = Final Score

69 x 1.0 = $\boxed{69}$

HAZARD ASSESSMENT RATING FORM

NAME OF SITE Waste Holding Area (Site No. 2)

LOCATION Area 1

DATE OF OPERATION OR OCCURRENCE 1980-1990

OWNER/OPERATOR Fort Indiantown Gap Air National Guard Station

COMMENTS/DESCRIPTION

SITE RATED BY Science & Technology, Inc.

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1000 ft. of site	3	4	12	12
B. Distance to nearest well	2	10	20	30
C. Land use-zoning within 1-mile radius	3	3	9	9
D. Distance to installation boundary	3	6	18	18
E. Critical environments within 1-mile radius of site	2	10	20	30
F. Water quality of nearest surface water body	1	6	6	18
G. Groundwater use of uppermost aquifier	2	9	18	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by groundwater supply within 3 miles of site	2	6	12	18
		Subtotals	115	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 64

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) S
2. Confidence level (C = confirmed, S = suspected) C
3. Hazard rating (H = high, M = medium, L = low) H

Factor Subscore A (from 20 to 100 based on factor score matrix) 60

B. Apply persistence factor
Factor subscore A x Persistence Factor = Subscore B

60 x 1.0 = 60

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

60 x 1.0 = 60

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists, then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 80

B. Rate the migration potential for 3 potential pathways: Surface water migration, flooding, and groundwater migration. Select the highest rating, and proceed to C.

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water	3	8	24	24
Net precipitation	2	6	12	18
Surface erosion	1	8	8	24
Surface permeability	2	6	12	18
Rainfall intensity	2	8	16	24
		Subtotals	72	108

Subscore (100 x factor score subtotal/maximum score subtotal) 67

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
2. Flooding	0	1	0	3

Subscore (100 x factor score/3)

3. Groundwater migration 0

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to groundwater	2	8	16	24
Net precipitation	2	6	12	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to groundwater	3	8	24	24
		Subtotals	68	114

Subscore (100 x factor score subtotal/maximum score subtotal) 60

C. Highest pathway score

Enter the highest subscore value from A, B-1, B-2, or B-3 above

Pathways subscore 80

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	64
Waste Characteristics	60
Pathways	80

Total 204 divided by 3 = 68

Gross Total Score

B. Apply factor for waste containment from waste management practices.

Gross Total Score x Waste Management Practices Factor = Final Score

68 x 1.0 = $\boxed{68}$

HAZARD ASSESSMENT RATING FORM

NAME OF SITE Old Waste Holding Area (Site No. 3)

LOCATION Area 2

DATE OF OPERATION OR OCCURRENCE 1975-1986

OWNER/OPERATOR Fort Indiantown Gap Air National Guard Station

COMMENTS/DESCRIPTION

SITE RATED BY Science & Technology, Inc.

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1000 ft. of site	3	4	12	12
B. Distance to nearest well	3	10	30	30
C. Land use-zoning within 1-mile radius	3	3	9	9
D. Distance to installation boundary	3	6	18	18
E. Critical environments within 1-mile radius of site	2	10	20	30
F. Water quality of nearest surface water body	1	6	6	18
G. Groundwater use of uppermost aquifier	2	9	18	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by groundwater supply within 3 miles of site	2	6	12	18
		Subtotals	125	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 69

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) S
2. Confidence level (C = confirmed, S = suspected) C
3. Hazard rating (H = high, M = medium, L = low) H

Factor Subscore A (from 20 to 100 based on factor score matrix) 60

B. Apply persistence factor
Factor subscore A x Persistence Factor = Subscore B

60 x 0.9 = 54

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

54 x 1.0 = 54

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists, then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: Surface water migration, flooding, and groundwater migration. Select the highest rating, and proceed to C.

1. Surface water migration

Distance to nearest surface water	2	8	16	24
Net precipitation	2	6	12	18
Surface erosion	1	8	8	24
Surface permeability	2	6	12	18
Rainfall intensity	2	8	16	24
		Subtotals	64	108

Subscore (100 x factor score subtotal/maximum score subtotal) 59

2. Flooding	0	1	0	3

Subscore (100 x factor score/3)

3. Groundwater migration 0

Depth to groundwater	2	8	16	24
Net precipitation	2	6	12	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to groundwater	3	8	24	24
		Subtotals	68	114

Subscore (100 x factor score subtotal/maximum score subtotal) 60

C. Highest pathway score

Enter the highest subscore value from A, B-1, B-2, or B-3 above

Pathways subscore 60

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	69
Waste Characteristics	54
Pathways	60

Total 183 divided by 3 = 61 Gross Total Score

B. Apply factor for waste containment from waste management practices.

Gross Total Score x Waste Management Practices Factor = Final Score

61 x 1.0 = $\boxed{61}$

Fort Indiantown Gap Air National Guard Station
Annville, Pennsylvania

USAF Hazard Assessment Rating Methodology
Factor Rating Criteria

The following is an explanation of the HARM factor rating criteria for the three potential sites identified at the Station:

I. Receptors

A. Population Within 1000 feet of Site.

Site Nos. 1-3, Factor Rating 3. The weekend population within 1000 feet of Site Nos. 1 and 3 is approximately 300 persons on Unit Training Assembly (UTA) weekends. The population within 1000 feet of Site No. 2 is 260 persons on weekends.

B. Distance to Nearest Well.

Site Nos. 1 and 3 have Factor Ratings of 3. They are located 900 feet and 800 feet, respectively, from the nearest water well. Site No. 2 has a Factor Rating of 2 because it is located 3300 feet from the nearest water well.

C. Land Use-Zoning (within 1-mile radius).

Site Nos. 1-3, Factor Rating 3. The Fort Indiantown Gap Military Reservation is not officially zoned by local civilian authorities. However, there are private residences within the 1-mile radius and military personnel are billeted on the reservation.

D. Distance to Installation Boundary.

Site Nos. 1-3, Factor Rating 3. Site No. 1 is 75 feet from the installation boundary. Site No. 2 is 275 feet from the boundary, and Site No. 3 is 150 feet from it.

E. Critical Environments (within 1-mile radius).

Site Nos. 1-3, Factor Rating 2. Small wetland areas are located within a 1-mile radius of each site.

F. Water Quality/Use Designation of Nearest Surface Water Body.

Site Nos. 1-3, Factor Rating 1. Qureg Run and its unnamed tributary are classified as warm water fisheries.

G. Groundwater Use of Uppermost Aquifer.

Site Nos. 1-3, Factor Rating 2. The uppermost aquifer is used as a source of drinking water, but municipal water from surface water sources is available at certain locations in the area.

H. Population Served by Surface Water Supplies Within 3 Miles Downstream of Site.

Site Nos. 1-3, Factor Rating 0. No one in the area is served by surface water supplies obtained within 3 miles downstream of these sites.

I. Population Served by Aquifer Supplies Within 3 Miles of Site.

Site Nos. 1-3, Factor Rating 2. Based on a count of 197 wells within a 3-mile radius of the Station, given the assumption that most of these are household wells and that there are 3.8 individuals per household, it is very broadly estimated that approximately 750 people receive water from aquifer supplies.

II. Waste Characteristics

Site No. 1

A-1: Hazardous Waste Quantity - Factor Rating M (Moderate). As many as 1320 gallons of mixed waste oil, brake fluid, diesel fuel, paint thinner, PD-680 solvent, and trichloroethane may have been disposed of at this site.

A-2: Confidence Level - Factor Rating C (Confirmed). This site was confirmed through interviews with Station personnel.

A-3: Hazard Rating - Factor Rating H (High). This site was given a high hazard rating because of the high toxicity of many petroleum products.

Site No. 2

A-1: Hazardous Waste Quantity - Factor Rating S (Small). Approximately 250 gallons of liquid wastes may have been spilled at this site.

A-2: Confidence Level - Factor Rating C (Confirmed). This site was confirmed through interviews with Station personnel.

A-3: Hazard Rating - Factor Rating H (High). This site was given a high hazard rating because of the high toxicity of PCBs.

Site No. 3

A-1: Hazardous Waste Quantity - Factor Rating S (Small). The quantities of hazardous wastes spilled at this site are unknown. For calculation purposes, a small quantity is used.

A-2: Confidence Level - Factor Rating C (Confirmed). This site was confirmed through interviews with Station personnel.

A-3: Hazard Rating - Factor Rating H (High). This site was given a high hazard rating because of the high toxicity of many petroleum products.

B. Persistence Multiplier for Point Rating.

Site Nos. 1 and 3 were assigned a persistence multiplier of 0.9 based on the presence of PD-680 solvent. This material corresponds to the HARM category of "Substituted and Other Ring Compounds."

Site No. 2 was assigned a persistence multiplier of 1.0 based on the possible presence of PCBs. These materials correspond to the HARM category of "Metals, Polycyclic Compounds, and Halogenated Hydrocarbons."

C. Physical State Multiplier.

A physical state multiplier of 1.0 was applied to Site Nos. 1-3 because the substances spilled or disposed of at these sites were liquids.

III. Pathways Category

A. Evidence of Contamination.

Site Nos. 1 and 3 were given a Factor Rating of 0. No oil staining or other evidence of contamination is visible at these sites. Site No. 2 was given a score of 80 (Indirect Evidence) because it is greatly suspected of being a source of contamination. Heavy oil staining is currently observable at the site.

B-1. Potential for Surface Water Contamination.

- Distance to Nearest Surface Water: Factor Rating 3 for Site Nos. 1 and 2. These sites are located within 500 feet of storm sewer lines. Site No. 3 was given a Factor Rating 2. It is located approximately 800 feet from an unnamed tributary of Qureg Run, which receives sheet drainage from the site.

- Net Precipitation: Factor Rating 2. The average annual net precipitation for Site Nos. 1-3 is 14 inches.

- Surface Erosion: Factor Rating 1. Surface erosion is slight at Site Nos. 1-3.

- Surface Permeability: Factor Rating 2. The surface permeability at Site Nos. 1-3 is 4.24×10^{-5} to 4.24×10^{-3} cm/sec.

- Rainfall Intensity Based on 1-Year, 24-Hour Rainfall: Factor Rating 2. The rainfall intensity at Site Nos. 1-3 is 2.5 inches.

B-2. Potential for Flooding.

Factor Rating 0. Site Nos. 1-3 are located beyond the 100-year flood plains of local streams.

B-3. Potential for Groundwater Contamination.

- Depth to Groundwater: Factor Rating 2. The depth to groundwater at Site Nos. 1-3 is 15 to 20 feet.

- Net Precipitation: Factor Rating 2. The average annual net precipitation for Site Nos. 1-3 is 14 inches.

- Soil Permeability: Factor Rating 2. The soil permeability for Site Nos. 1-3 is 4.24×10^{-5} to 4.24×10^{-3} cm/sec.

- Subsurface Flows: Factor Rating 0. The bottoms of Site Nos. 1-3 are greater than 5 feet above high groundwater level.

- Direct Access to Groundwater: Factor Rating 3. Because of the extensive structural deformation of the area, fracturing of the bedrock beneath Site Nos. 1-3 is probable.

IV. Waste Management Practices Factor

Since there is no containment at Site Nos. 1-3, a multiplier of 1.0 is used.